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Some Historical Notes Relative to the Invention and Development of the "Slide Rest."

BY W. F. DURFEE.

In treatises on the construction of machine tools, and in technical journals, the invention of the "slide rest" is, by English and American writers, almost universally attributed to Henry Maudslay (born 1771, died 1831), an Englishman who learned the trade of a blacksmith, and in early life entered the service of Joseph Bramah, the reputed inventor of the hydraulic press and Bramah lock. Maudslay's great ability soon raised him to the position of superintendent of Bramah's shops, and it was while serving in this capacity that he constructed a "slide rest," which his fellow-workmen named "Maudslay's go cart."

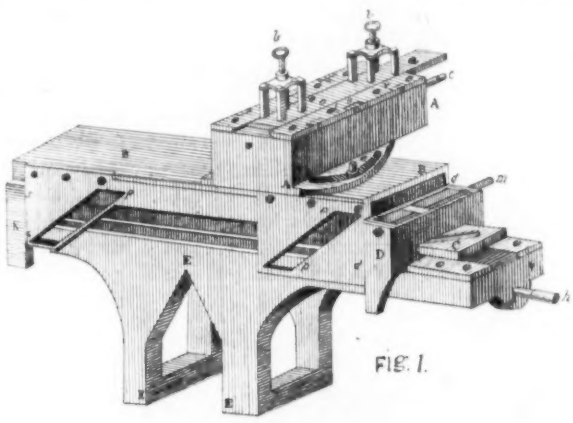


FIG. 1.

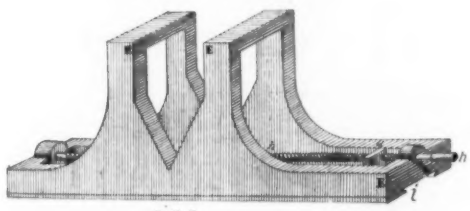


FIG. 5.

FIG. 6.

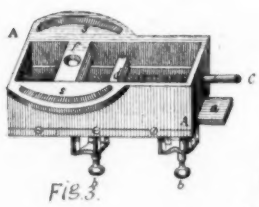


FIG. 3.

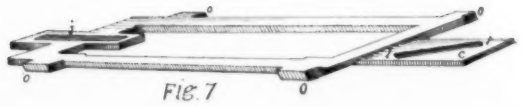


FIG. 7

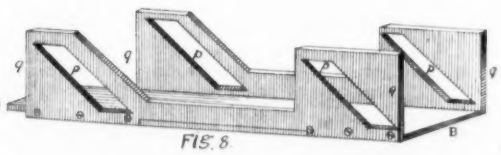


FIG. 8.

FIG. 2.

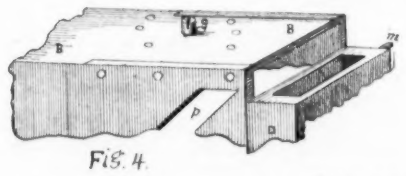


FIG. 4.

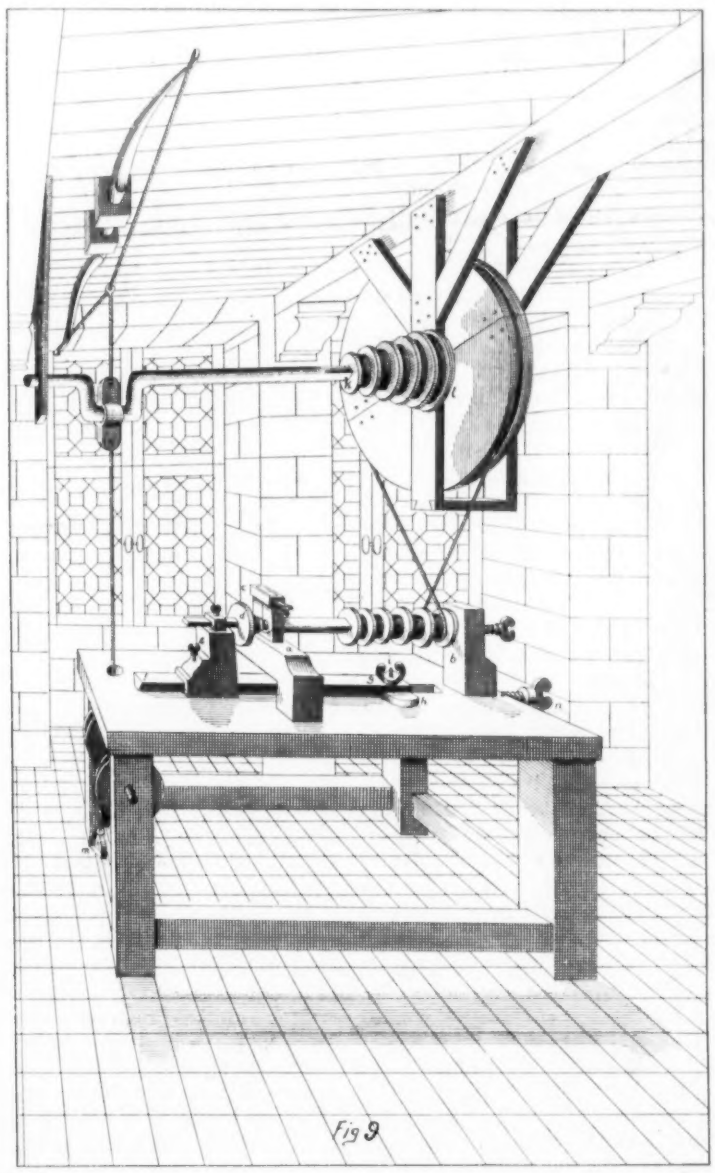


FIG 9

SOME OF THE EARLIEST SLIDE RESTS.

In 1797 Maudslay closed his connection with Bramah's establishment, and commenced business for himself; he spent most of his active life in London, and his fame as a mechanician became world-wide, and it rests upon a much more substantial basis of achievement than the invention of a form of "slide rest" not nearly so good as some that preceded it by many years. Maudslay's "slide rest" was undoubtedly original with himself, but it has never been adopted in the workshops of the world, and when considered in comparison with much older devices for holding and controlling the movements of a turning tool, it must be regarded as so clumsy and complicated as not to deserve adoption, and it is difficult to understand the encomiums heaped upon this contrivance, both by cotemporaries of Maudslay, and also by recent writers, save on the theory that they were unaware of what had been accomplished by other inventors. The late James Nasmyth (the reputed inventor of the steam hammer) said: "It is not, indeed, saying at all too much to state that its [the slide rest of Maudslay] influence in improving and extending the use of machinery has been as great as that produced by the improvement of the steam engine," and a modern enthusiast, one Mallock, has evidently been inspired by Mr. Nasmyth, for he says [in a work entitled "Labor and Popular Welfare"]: "Henry Maudslay, by introducing the 'slide rest,' did at a single stroke for all mechanics in the country what Watt, after years of effort, was unable to do for any of them." Now let us see just what kind of a slide rest or "go cart" Maudslay contrived, and compare his work with what had been done by others, and we will then be in a position to judge whether the above extravagant claims have adequate justification.

In Fig. 1 we have a perspective view (from Gregory's "Mechanics," 1815) of the slide rest of Maudslay. In this view *E E E* is an opening formed to bestride the triangular bar of iron which formed the bed of Maudslay's lathe, to which the rest can be secured in any desired position by means of a clamping plate *a b*, Fig. 2, which passes beneath the triangular bar of the bed, and through the two stirrups of the opening *E E E*; in the center is a binding screw *c*, by which the clamping plate is made effective. The turning tool is secured on two holders or tool posts, *b b*, Fig. 1, by their binding screws. These tool posts are fastened to a sliding plate *a*, which can be moved in the direction of its length by the screw *c*, thus causing the tool to advance or recede. Fig. 3 represents the box *A A* (Fig. 1) turned bottom upward; in it is seen the screw *c*, fixed at each end, and passing through the nut *d*, which is attached to the under side of the plate *a*. When it is necessary (as in turning the inside of cones, etc.) that the tool should not move parallel with the axis of the lathe, the screw *e* (Fig. 1), and another similar one behind the box *A A*, must be loosened, the box *A A* set at the proper angle, and then made fast by these screws. In order to make the box *A A* move truly when turned, there is a hole *f* (Fig. 3) to receive a pivot *g* (Fig. 4) upon the plate *B*, which acts as a center, on each side of which are three holes in the plate *B* to put the screw *e* (Fig. 1) in as required, thus giving to the tool a greater angular range than the sectoral openings *S S* (Fig. 3) would otherwise permit. The base piece *E E E* (Fig. 1), represented separately and inverted in Fig. 5, is of cast-iron, and has a screw *h* (similar to that in Fig. 3) within it; the nut of this screw is attached to the bottom of the slide *H* (Fig. 6) at *l*; this slide moves in the groove *i* (Fig. 5). At one end of the slide *H* (Fig. 6) is a box containing a screw *m*, and at the other is a frame of brass *K K*; near this end of the slide *H* is a pin *L* projecting above the plate; this pin is put through a slot *J* (Fig. 7), while the other end *C*, of Fig. 7, is passed through an opening *M* in the lower part of

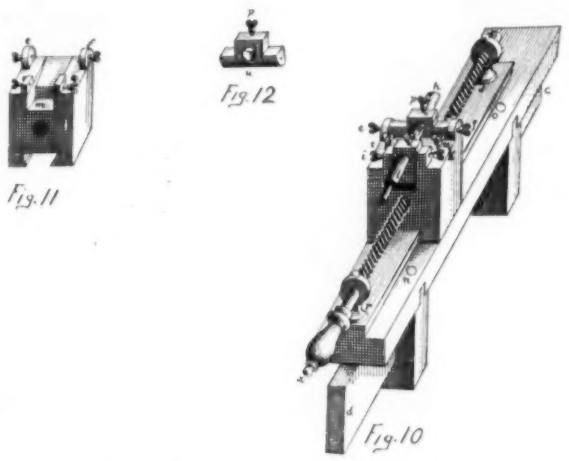
the base *D*, Fig. 6. In the part *C*, Fig. 7, is an oblique slot *l l*, which receives a projection from the bottom of the nut *n*, moved by the screw *m*, Fig. 6; by this arrangement, it is obvious that if the screw *m* is rotated, the projection on the nut *n*, acting against the side of the oblique slot *l l*, will move it either backward or forward through the opening *M* (Fig. 6). Near the four corners of the frame, Fig. 7, are four small projections, *o o o o*, having inclined sides, which fit into the four openings, *p p p p*, of Fig. 8 (shown inverted); these openings are cut in two brass plates, which are screwed on at right angles to the plate *B B* (Figs. 4 and 8); the ends, *q q q q*, of these plates slide between the edges of the frame *K K* and the box *D* (see Fig. 1), so as to prevent any other than a vertical movement of the said plates. The inclined projections, *o o o o*, on the sides of the frame, Fig. 7, acting in connection with the inclined slots *p p p p*, in Fig. 8 (see also Fig. 1), serve when put in motion by turning the screw *m* (Figs. 1 and 6), to raise or lower the tool; in order to make the slides move without lateral looseness, the gibs forming the sides of the grooves in which the slides move are provided with oblique screw holes and pushing screws.

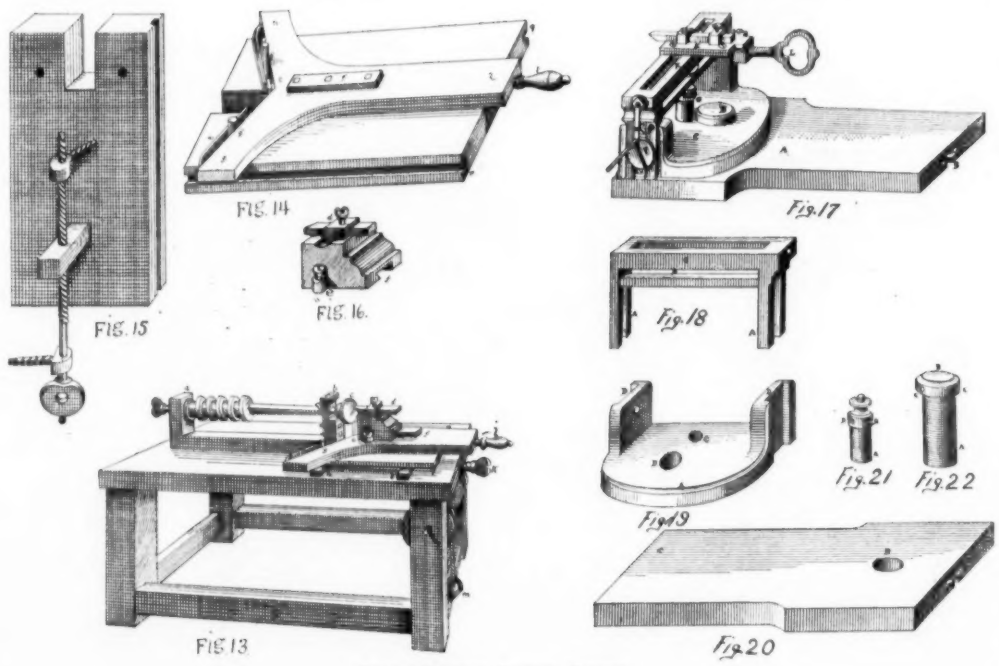
Such was Maudslay's slide rest, and it very naturally suggests David's idea of the structure of man, for it is certainly "fearfully and wonderfully made."

We will now turn our attention to some of the slide rests of a much earlier date than that of Maudslay. One of the first attempts of which we have any account, to provide means for holding and controlling with precision the cutting tools of lathes, is illustrated in the work of Jacobi Bessoni (1578), by an engraving of a rude lathe for cutting wooden screws. In this lathe the cutting tool was held and guided by a sliding bar whose movements were controlled by a guide screw.

In a curious work entitled "La Dioptrique Oculaire, on la Theorique, la Positive, et la Mechanique de L'oculaire Dioptrique en toutes ses especes. Par le Pere Cherubin d'Orleans, Capuchin. A Paris, 1671," we find a number of interesting lathes provided with slide rests especially contrived for rough shaping concave and convex lenses. Plate 58 of this work is reproduced as Fig. 9. It will be noted that the lathe was driven by the foot of the operator, acting by means of the stirrup *m*, an overhead crank shaft, and a reacting bow fastened above the crank to the ceiling timbers of the room. The crank shaft was provided with a large grooved pulley which doubtless also did duty as a fly wheel, and there was a cone pulley by which means a large range of speeds could be given to the lathe mandrel. The rear end of this mandrel turned on a pivot adjusted by a screw, and the forward bearing of the mandrel was conical (there are details of this mandrel given in the work). On the forward end of the mandrel the lens *d* to be roughed out was secured and operated upon by a tool fastened in a tool post by a pinching screw, quite in the modern way. The tool post had a dovetail groove in its base which was made to fit and slide upon a radius bar *f g*, which could be moved upon the table about a center *i*, placed immediately below the axis of the lathe mandrel. To this radius bar the tool post could be secured at any desired point by the binding screw *e*, and the tool could be made to approach or recede from its work by the screw *n*, which moved a block in which the pivot *i* was located; and the tool could be moved laterally by the hand of the operator so as to cause it to work over the whole surface of the lens *d*.

As above described, this lathe and its rest mechanism was not adapted to roughing out other than convex lenses; but by removing the tool post and radius bar *f g*, and putting in their place the apparatus shown in Fig. 10, both convex and concave glasses could be shaped; it consisted of a bed piece *n o*, which could be clamped to the top of the lathe table by the wedges *c d*. On the top of the bed piece was a radius bar *r s*, which could be made to swing about a pivot at either end at pleasure. The tool post had on its under side a dovetail groove made to fit and slide upon the radius bar, its movement being occasioned and controlled by turning the screw *x*. When the bed piece *n o* was clamped to the top of the lathe table, care was taken that the vertical plane which contained the axis of the lathe mandrel also contained the two centers about which the radius bar *r s* turned; care was also taken that the bed piece *n o* and screw *x* when clamped to the lathe table, passed sufficiently far under the support *a* (Fig. 9) of the forward bearing of the lathe mandrel to permit the shaping of convex lenses, and that it projected sufficiently far outside of said support *a* to enable the tool to shape concave lenses, the tool post being always outside of said support. Whenever this apparatus was used for shaping a convex lens, the radius bar with the tool post was made to turn about a pivot under the lathe mandrel, its outer end being free to move laterally as required; but whenever a concave lens was to be roughed out, the pivot was shifted to the other end of the radius bar, and the end under the lathe mandrel could then be moved laterally. The means of holding the tool and of obtaining a vertical adjustment for its point were very peculiar. The body of the tool was cylindrical and passed through a hole in a trunnion block which was supported by the pivot screws *e f* (Figs. 10 and 11). This trunnion block is seen detached in Fig. 12. The tool also passed through a round hole in a rectangular block, which could be raised or lowered in the rectangular opening *m*, Fig. 11, in the tool post, and fastened at any hight by the pinching screws *i k*, Fig. 10; and by raising or lowering this block the tool was made to tilt about the pivot screws *e f*, holding the trunnion block, and the point of the tool moved in a degree corresponding to this movement. The tool was secured against longitudinal movement by pinching screws *p* and *q*, in the trunnion and adjusting blocks. Fig. 11 is a view of the tool post divested of the trunnion and adjusting block. Our ancient Capuchin optician had still another method of operating a slide rest for the shaping of lenses; and in Fig. 13 we have a perspective view of the mechanism of this method as arranged for the roughing out of convex lenses. The apparatus consists of a flat plate of metal having grooved sides and a maneuvering screw beneath (this plate is shown inverted in Fig. 15) which is held to and guided in its movements on the table of the lathe by clips *h i*, Fig. 13 (there being two others on the opposite edge of the plate) which are fastened to the table and have tongues which enter the edge grooves of the plate; whose upper surface supports a Y-shaped piece of metal whose arms are in contact with two cylindrical guide pins *g g* (attached to the first moved plate) and are held in such contact by two powerful flat steel springs fastened to the arms of the Y; which is free to move laterally in obedience to a force applied at the handle *i*, and its movements are guided by the contact of the arms of the Y with the aforesaid guide pins *g g*. Upon the upper surface of the aforesaid Y a dovetailed bar *f* is fastened, which serves to hold and guide the tool post (Fig. 16) which has in its base a groove made to fit and slide upon the bar *f*. The turning tool is held in the tool post by a pinching screw *d*, and the tool post is fastened in any desired position on the bar *f*, by two pinching screws, one of which is seen at *e* (Fig. 16). The tool is made to advance and recede by the movement of the bottom plate by means of the screw *K*, Fig. 13. These various forms of slide rest were invented by Cherubin d'Orleans and published





Some Early Slide Rests.

but a few years backward in history, he would not have been tempted when speaking of the work of Maudslay to add to his plagiarism from Nasmyth, the following grossly ridiculous specimen of pseudo-eloquence: "The power of one man thus descended on a thousand workshops, and sat on each of the laborers like the fire of an industrial Pentecost."

In 1776 Jesse Ramsden, an English mathematical instrument maker, constructed a slide rest for use in cutting the endless screw for his dividing engine. This rest was moved by a guide screw, which was provided with "change wheels," in fact, the mechanism was substantially the same as that of a modern screw-cutting lathe. A description of this machine of Ramsden was published in 1777, when Maudslay was but six years of age.

In 1776 in a work entitled "L' Art de Tourner en perfection, par Le R. P. Charles Penmier, Leipsig, 1776," a slide rest was illustrated, which was quite similar to that in the French Encyclopédie above described.

In view of the above facts, and of others of a similar character, which are well known, it is quite evident that civilization is not under any great obligation to "Maudslay's go cart" for its progress. Had Mallock read

In the tenth volume of plates illustrating the great French Encyclopédie (1772) the following engravings of a slide rest are found:

The bed plate *A*, Figs. 17 and 20, has a T-shaped groove on its under side by which it can be clamped to the bed of a lathe; upon this rests a semicircular plate *C*, Fig. 19, provided with two grooved uprights *D D*; this plate can turn about and be clamped to the bed plate by the capstan-headed screw *B* (Figs. 17 and 22), and is also tapped to receive the capstan-headed elevating screw *G* (Figs. 17 and 21), upon the head of which rests a rectangular frame, Fig. 18, having slotted legs *A A*, which are fitted to slide vertically in the grooves in the uprights *D D*, Fig. 19. Through the slots in the legs *A A* of this frame pass screws having broad heads, which serve to clamp the frame when it is adjusted to the proper hight by the elevating screw *G*; on the inside of this frame (see Figs. 17 and 18) there is a long screw which turns in bearings at each end of the frame, and is operated by the crank *N*, Fig. 17; on this screw is a nut, which is also fastened to a plate resting upon the top of the frame; this plate carries a slide which can be moved at right angles to the frame by the screw *L*, Fig. 17, and this slide supports the turning tool. From the construction, it is evident that the tool can be readily adjusted for hight, and that it can easily be moved in two planes at right angles to each other, and that the parts can be so adjusted that the tool can be mechanically moved in any required line not parallel with the axis of the lathe, and, in fact, that this form of slide rest, which was well known more than twenty years before Maudslay's attempt, could do all that was possible for his device, and was at the same time much simpler and cheaper, and it is evident that the improvement of the slide rest has advanced along the lines of this French invention, and that no original feature of Maudslay's rest has survived.

The Competition of Women.

So advanced an advocate of woman's rights as Lady Dilke has more than once warned women workers not to compete against their husbands, fathers and brothers, lest their last state should become worse than their first. The social and the physical results of women's forsaking the home for the factory have in various parts of the country been anything but encouraging to the sticklers for equality between the sexes. In Lancashire women's labor in factories has almost entirely destroyed the home life of the operative class, and led to an alarmingly high rate of mortality among infants. It is tending also to the enervation and the moral degeneracy of the male population. Among Lancashire weavers it is not an uncommon thing for the young men to select for wives mill-hands who can maintain them in partial or entire idleness. Many families there rely more upon the women bread winners than upon the men.

The physical and the social consequences of the system are deplorable, and the new factory act will not tend to improve things much. From the wages point of view, the workers, as a class, gain nothing by it. The competition by women tends to keep wages down. Among the weavers, although, as the machinery is driven faster and payment is made by the piece, more is earned to-day than formerly, the rate paid is virtually the same as it was forty years ago. In nearly every employment which does not suffer from competition by women the rate of wages is from 50 to 70 per cent. higher now

than it was then. It is only among the weavers that the rate of payment rules so low in Lancashire. In the spinning and other departments of the cotton industry the men have by their unions more generally kept women out, and as a rule the workers earn nearly double the wages of weavers. Their homes, consequently, are more comfortable, and their womenfolk more generally cultivate the domestic virtues. The cotton trade is only one illustration of many that might be cited to show the ill results of the abandonment by women of what has hitherto been deemed the sex's natural functions in order to enter men's sphere of labor. Similar effects will doubtless be observable elsewhere as man is dispossessed by his competitors.—*The Realm.*

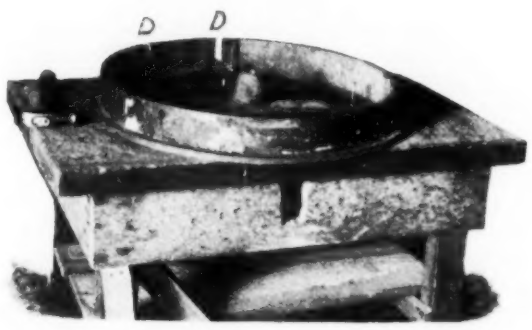


Fig. 32.

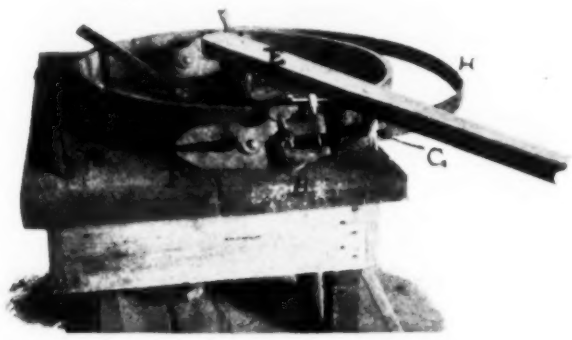


Fig. 33.

Fig. 34.

Bicycle Tools—V.

MAKING WOOD RIMS.

The following engravings and text illustrate the rim bending and gluing at the St. Nicholas cycle shops, 222 Fullerton avenue, Chicago, Ill.

The proceeding is to first steam the elm-rim strip soft, then apply to the outside a full length flexible steel band, hooked at one end as at *A*, Fig. 33; this band hook abuts against one end of the strip; near the other end the band and strip are clamped together with the small screw clamp *B*, Fig. 33, and the strap is then ready to be bent. Other methods apply a much more certain and unyielding abutment at each end of the strip than is gained by the use of the hooked band and the small screw clamp as described, yet there did not seem to be an undue proportion of rim strips broken in bending at the St. Nicholas shops, and hence it would appear that an exactly adjusted, unyielding end abutment is not an absolute necessity in rim bending. By the Plymouth methods the abutment is kept hard against the ends of the strip from the first to the last of the bending. The Plymouth strip is much greater in the cross-section than the St. Nicholas strip; indeed, the Plymouth strip is much larger than it need be to make any rim observed in process of manufacture, though it may not be too great for some patterns of rim. There is a considerable percentage of loss by breakage in all rim bending, and it is said that this loss is greatest where the rims are what is termed "machine bent," a process which will be noticed later. As the importance of the end abutments in wood bending increases very rapidly with increase of cross-section of strip it is quite likely that the good results obtained with the clamp fastening at the "St. Nicholas" are due more to the thorough steaming and thinness of the strip than to the end retaining devices exhibited.

When the iron band is hooked over one end of the strip and clamped to the other end, the strip is ready to apply to the bending form shown in Fig. 32. This is a flanged cast-iron ring with four arms and a bored central hub, and having two open slits *D D* about three-fourths of the way down in the vertical member of the frame, and also having an upwardly projecting finger cast on the rear side, half way between the slits; this finger is substantial, and stands far enough away from the upright member of the rim to permit the insertion of the iron-banded strip between it and the outside of the ring body; this bending form is fastened to the top of a wooden bench secured to the floor and braced against turning. The bored hub in the middle takes a round pin in one end of the wooden hand lever *E*, Fig. 33, which has also a second downwardly projecting pin *G*, the inside of which stands a little more than the thickness of the banded strip away from the outer surface of the form. As the flexible wrought-iron band is not removed from the freshly bent rim, but is allowed to remain until the rim is dry, there must be provided at the outset as many of the bands, and twice as many of the large clamps, *F*, as there are rims to be treated at one time. The use of the large clamps *F* is to hold the two ends of the bent rim together while the rims are drying. After they are once dried they retain their shape and size when the clamps and band are removed. To bend the banded strip one end is put between the finger *C*, Fig. 33, and the wall of the bending form, and the workman then walks round the form bench from left to right, pushing the constantly shortening free end of the rim before him as he goes, until he has completely wound the strip on the bending form. In case the rim proves too stiff to be forced up close against the form when it comes to the last foot or so, and is so shortened as to afford very little leverage to the hand, the lever *E* is brought into action, and the last end of the rim is forced up close, the two ends overlapping, one above the other, more than the distance between the clamp notches *D D*, Fig. 32. As soon as the last end of the rim lies close up against the form, the workman slips a little open U-shaped clamp over the end of the rim and the wall of the form, as shown at *I*, Fig. 34, and holds it while he takes off the small clamp *B*, Fig. 33, which holds the band to the strip; he next fastens the two ends firmly together by slipping one of the large hinged-jaw clamps *F*, Fig. 33, down into the left-hand notch *D*, and tightening the jaws on both the lapping ends of the rim by turning the clamp screw. This clamp has to have its jaws quite closely adjusted for width, as it must hold both ends of the strip individually and firmly; the strip ends do not lap in the line of the bite of the clamp jaws so that the clamp can force one rim end against the other, as would seem the natural way; the second clamp is then slipped the same way in the right-hand notch *H*, and the bent rim stands on the form, as shown in Fig. 35, ready to be taken off and put away to dry.

Complicated as this process seems, it is not so slow in use as might be imagined; one man alone can bend 200 rims in 10

Fig. 35.

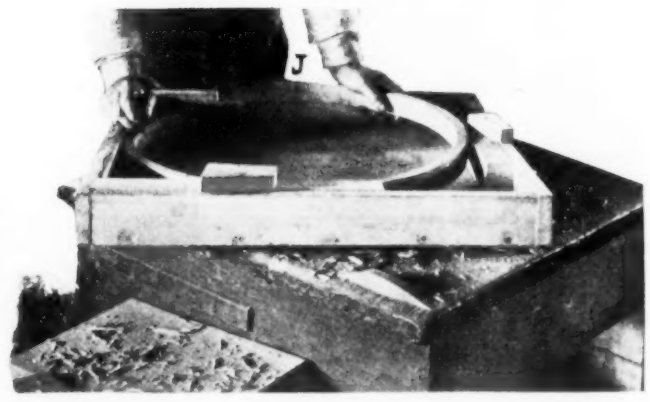


Fig. 36.

Fig. 37.

Fig. 38.

Fig. 39.

Wood Rim Making.

hours. At the Plymouth works the performance is only 12¼ per cent. better, though late improvements at the latter place probably increase the output. Many steps in the St. Nicholas process of rim bending could be far more rapidly done by two men, or by a man and boy, than by one man working alone, and it would not be at all surprising to see one man and a boy bend 500 rims in 10 hours by the St. Nicholas methods and with the tools shown. The method is objectionable chiefly in requiring the iron band to remain on the rim while drying, and the loss of time in handling the small retaining clamp. The St. Nicholas formerly held the ends of the bent rim together in a quite different way, by the use of a wooden block which formed a movable segment of the bending form, and was provided with holes near the segment ends to take the inner legs of two inverted U-clamps of ½-inch round wrought-iron; one of these clamps was dropped into its leg seat in the segment, its other outer leg passing over the outside of the band and strip, and made fast by driving a wooden wedge between the clamp leg and the strap, and then the other was secured in the same way, the wedges being wide enough to bind on both ends of the bent rim; the long-jawed screw clamps are considered an improvement. The Plymouth method of fastening the ends of the bent rims together includes the movable segment of the bending form, but does not employ screw clamps, nor does it confine the flexible iron band to each rim as bent; the iron band is a part of the bending machine, and never leaves it, so that only one iron band is needed for each bending machine, no matter how many rims are bent.

The Plymouth bent rims are measured on the inside with a traveling wheel, tire setting style. At the St. Nicholas the rims are placed inside of a simple square wooden frame, which is made large enough for the largest rim, and blocked in on two sides for the various smaller sizes, all as shown in Fig. 36. The rim is put inside this box gage, which, of course, accurately determines the outside diameter, and then a pencil mark *J*, Fig. 36, is made on the inside of the rim; next the rims are taken to a band saw and held by both the sawyer's hands, so that the pencil marks coincide while both ends are cut off at the same time, one hand being able to mark and cut 600 rims accurately to length in 10 hours.

The St. Nicholas joint is made by cutting tenon seats in each end with four saws in the vertical spindle shaper, as clearly shown in Fig. 37. These rim ends merely abut, not slipping into each other as might be thought; the four long, thin tenon seats being filled with separate tenons. In Fig. 37 the work guides *K* and *L* are bolted to the iron table of the shaper, and the wooden stretcher *M* is forced in across the diameter of the rim to keep the ends open while the tenon seats are being cut; the necessity of the guides *K* and *L* will be at once seen by the shaper hand.

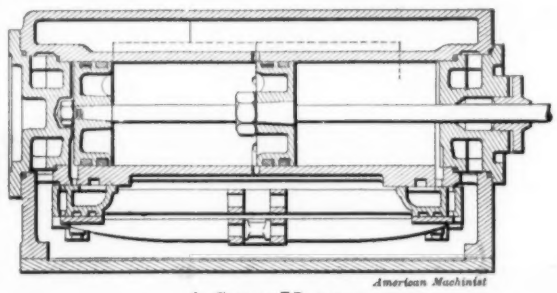
Fig. 38 shows the method of gluing the rims too plainly to need description. Fig. 39 shows the glued rim embraced once more by a flexible iron band drawn very tightly around it by means of a clamp which was overlooked and cannot now be described. This clamp holds the rim ends together while the tenons are being driven one at a time into their seats in the rim. One man can joint 150 rims per day on the shaper, according to the figures given by Mr. Scherling, the superintendent, but I am certain I saw rims jointed at the rate of 600 or 700 in 10 hours; the operation was very rapid. The figures for gluing up are given at 100 per day, which seems very much less than would be expected; Mr. Scherling also gives 300 outside cuts, or 250 inside cuts, on rim turning as 10 hours work, which is quite different from the figures given by the turner himself last May, when the lathes were first put at work.

In regard to rim turning, there have been some very curious results obtained. Mr. Marble, at the Plymouth shops, showed me a very well constructed fixture and a costly tool, too, made to hold a rim while being shaped on a shaper instead of turning it in a lathe, and said the best output obtainable was 50 rims per day, finished. I also saw several special rim-shaping machines in a large shop (not to be named, east of New York), which were standing idle, while a row of lathes on wooden frames were actively at work turning rims. This would seem conclusive evidence that the lathe was superior to the shaper for finishing wood rims for cycle wheels; yet at a shop in Milwaukee I saw two special machines, each of which was said to be able to turn out 600 rim cuts, either outside or inside, per day. These machines were well designed, the rim being perfectly supported. The two machines also stood close together so that one man might possibly attend both; with two men these machines, which are shaper style, would beat the best lathes seen so far, and in this Milwaukee shop what looked like a good double-end rim-turning lathe was standing still while the shaping machines were at work. On these Milwaukee shaping machines the rim support was perfect, however, and to this feature alone possibly their great efficiency is due.

Hugh Dolnar.

A Novel and Complete Steam Jacket.

We illustrate a method of steam jacketing for steam engines, devised by M. G. Lacroix, and recently described in the *Revue Industrielle*. It will be seen that this device secures a more thorough and complete jacketing of the surfaces than any other system



A Steam Jacket.

in use, as the entire cylinder, both cylinder heads and both faces of the piston are placed in complete communication with the live steam. The principal novelty in the arrangement is in the means by which the piston is heated. To accomplish this the piston is elongated, or its two faces are separated, so that there is a space somewhat greater than the stroke of the piston between them, and, of course, the cylinder is elongated to correspond. The entire cylinder being jacketed a hole is placed communicating between the cylinder jacket space and the interior of the piston, and in such a position that it will always be within the working faces of the piston. Two such holes are, in fact, provided, one at the top of the cylinder, and the other at the bottom, the cylinder being horizontal, and by this means the water of condensation is constantly drained from the interior of the piston. Thus it will be seen that all the surfaces with which the steam comes in contact in the cylinder are steam jacketed, a thing which we believe has never before been practically accomplished. The same arrangement would seem to be also well adapted for cold jacketing an air compressing cylinder, the water or other cooling liquid circulating precisely in the same manner as the steam. It will be noticed that whether employed for heating the working surfaces of the steam cylinder, or for cooling the corresponding surfaces of an air-compressing cylinder, this arrangement does more than the jacketing of the entire surfaces; for the live steam inclosed between the piston faces in the steam cylinder, is by the travel of the piston brought successively in contact with almost the entire interior surface of the cylinder, and in this way accomplishes more in the way of heating the working surfaces than it does by conduction through the cylinder walls, and the same is true as to the effective cooling that may be accomplished in the air-compressing cylinder.

Design for a V-Threading Tool—Lead Lapping.

The accompanying cuts represent a practical lathe tool that I designed for my own use that is especially calculated to do very small work in a large engine lathe.

It may be said that work of this class should be done in small bench engine lathes, but they are not to be had in the average shop, while occasions for doing such work are not infrequent.

The time and labor lost in getting ready to do one such job, and the one or two pieces spoiled in getting one right, would go far towards paying for such a tool as this one.

In the drawing, *E* shows the body of the tool, which should be a steel forging; and a slot or opening is made at (*a*) for a follow, or lead rest attachment, whichever is used. The part of tool which enters the tool post is as large each way as will enter a ¾x1¼ opening in the latter.

It should be planed up and laid out carefully, and centered and drilled on the line of the tool shaft *G*.

If the piece were a solid forging it might be centered, placed between the lathe centers, the face plate with angle plate being on the lathe, the angle plate may be brought up to the side of piece *E* and fastened to the face plate securely, piece *E* being clamped firmly next to the angle plate, not forgetting to place a piece of paper between angle plate and work, or, when necessary, between work and face plate to prevent slipping. Then a hole, say, $\frac{1}{32}$ inch under the finishing size, which is ⅛ inch, may be made with a flat or chuck drill, the drill being run nearly through, when the plate is taken off, the lathe center removed, and the plate returned to its place and the drill run clear through. Then a boring tool may be used to start a true hole, and a reamer, made by removing a quarter section from a round steel rod, for the distance of an inch or so, may be used to extend this bore through straight. This reamer should be beveled on the end so that one side of the stock will form a cutting lip, and it should be slightly under ⅛ inch, so that a fluted reamer can be used to finish the hole out smooth. A lead arbor can be used to give an extra finish if desired.

The above way *may* be all right, but there is another one that *must* be, and one "must be" is worth a dozen "may bes."

In forging the piece *E*, whether the space where the binding block *F* comes in the drawing is forged out, milled out, or not removed at all, an extra amount of stock should be left at the end where the handle *O* comes. This should be ¾ inch round, and concentric with shaft *G*. It is to be used for back resting by, and then cut off. Now drill the hole for *G* from opposite ends on centers as true as possible.

Having drilled the piece *E* as described, use the centers as mentioned before for locating an angle plate, loosening the centers just enough to let the side of *E* adapt itself to the angle plate, then bore with lathe tool in slide or carriage rest, and ream out to size.

After this hold a piece of iron or Bessemer steel in a chuck, and turn a true plug on the end to fit the hole finished on the angle plate. Make it a wringing fit, and let it project so that the extension of piece *E*, with slot (*a*) in it will touch against the jaw of chuck, or a clamp attached to it, or the work for a driver. By touching lightly with lathe tool or graver at the edge of hole on opposite end of *E* the same can be centered to allow of turning off the part of forging left for back resting. Then back rest and bore and ream out the end at *O*. If the piece *E* is left solid instead of using *F*, which may be preferable, then, while the work is back rested, a chamber can be bored out in the middle of *E*.

After lapping out with a close-fitting arbor and fine emery, a perfect alignment between the opposite bearings *must* be the result.

It is customary in finishing out holes with lead arbors to leave the work longer than required, to be cut off afterwards, as the tendency is to make the hole largest at the ends, which is remedied by cutting off the surplus allowance. It is a good plan to make a set of steel taper arbors, and molds of cast-iron for use in a general jobbing shop, in preparing blanks for lead-lapping work.

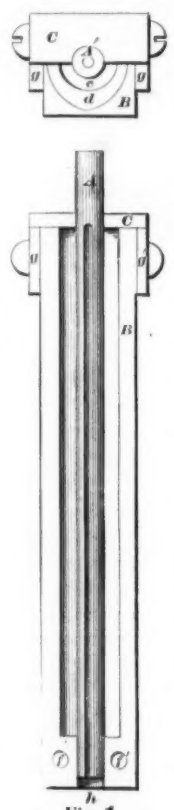


Fig. 1

The arbors should be slightly tapering, with a groove the whole length to prevent the lead from turning on them. A straight shank for the driving dog or chuck should be left at the large end, and the length of the arbors should be all that will allow of turning the lead readily. Being tapering, the blanks can be removed at will and others put in their place. In this way the same arbor can be used repeatedly, and having a supply of leads prevents the temptation to do poor work with a worn down, undersized arbor.

Fig. 1 gives an idea of such an arbor and mold, of which kind a series may be made, covering from ¼ inch on small end of smallest one up to ¾ inch or 1 inch on the largest end of largest one, embracing it may be 8 or 10 in the set.

Let the mold give about the proportion of lead to the steel arbor as that shown in the drawing.

In Fig. 1 *B* is the casting for the mold, the groove being cast in it, and about $\frac{1}{16}$ inch deeper than a half circle to allow for planing off the face *B* on both halves of the mold. *f f'* are for dowel pins, and *C* is

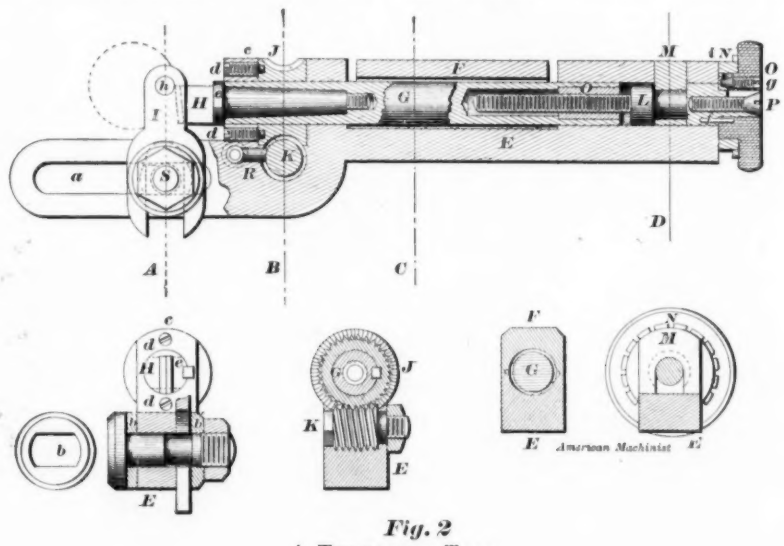


Fig. 2

A Threading Tool.

made of pliable steel or iron, bent over as shown and screwed to one side, *B*, of mold. The two projections on the same act as guides for the other side of mold, see *g g*. The half circle *A'* is located centrally to guide large end of *A*. The small end enters (*h*), and a pin must be placed in the mold to fill the groove in *A* at small end, or else (*h*) must be plugged up to keep the metal from escaping.

The exposed side of mold is made flaring at the upper end to allow pouring the lead in at (*e*).

To lap holes out true and straight, the lead must fit the hole closely, and fine emery must be used with oil.

Small grooves or spiral cuts must be distributed over the arbor to catch the surplus emery.

This operation, like smooth reaming, is not intended to remove stock, and it will be found that a thousandth or two is quite an item on hardened steel.

Returning now to a general description of Fig. 1, it will be seen that *G* is a movable tool spindle provided with a keyway, as seen in the cross-section, and a block should be made for it with a half-inch hole and key for holding the spindle in a vise while the tool *H* is put in or taken out. This will keep *G* from injury, and save strain on worm and wheel *K* and *J*.

J is graduated in regular degrees, and a setting line put on *E* at *e*. When in position to use, worm screw *K* is tightened or locked with screw and pin at *R*. The screw head shown by dotted lines is on the opposite outside of *E*. The two screws *d d* are used to keep the worm in place when *G* is removed.

M is a yoke well fitted both to opening in *G* and to neck in feed screw *L*.

When *M* is removed, *G* with all its fixtures, including tool *H*, screw *L*, and handle *O*, etc., can be taken out, without loosening *E* in the lathe tool post.

After sharpening *H* the whole can be returned without any readjusting.

Blanks for *H* should be drawn in on the 2-degree angle hole by screw at the end of taper, as shown. After they are drawn up tight the keyway shown on *H* should be milled to match the same in *G*, by setting the saw in the latter; making a dozen or so at one time.

That part of *H* shown at *e* should be left long enough to allow of milling flat places on opposite sides for a thin wrench, shown by dotted lines on the end view.

The advantages of this style of taper for many places are important. Where thin emery wheels are held on taper arbors in grinding machines, the superiority of this plan over that of hammering on the end of the arbor, or of twisting the taper in to hold it, and then forcing out with a pin entering the hole at the end of the taper, is seen with the eyes shut.

Driving around emery wheels is likely to break them, and when they are pushed and twisted into place they are always loosening and coming out, breaking the wheel or injuring the work, or both.

Tapers like this are fitted readily, as the standard block with taper hole allows the screw end to pass through. By putting the wrench on part *e*, a delicate tool at *H* is in no danger of being damaged, and so when the tool ready for use is screwed into *G* in the vise the keyway can be located by allowing key in block to pass through it, as it will have to anyway.

Twisting small tapers in and out with a pair of cutting pliers is well enough when they are to be thrown away after a few usings, but on permanent fixtures is worse than using a lathe wrench for a hammer.

J and *K* then, being graduated, admit of setting the tool *H* at the proper angle for cutting right or left-hand threads, spirals or keyways.

The handle *O*, secured to screw *L* by expanding screw at *P*, has a collar *N*, tightened at will, with binding screw and pin *g*. So when the tool point touches work at *h* then zero can be set at the gage mark on the top of *E*, and any depth of cut made in thousandths. The notches in the collar *N* are for turning it with spanner or otherwise.

The screw *L* is cut left hand, 20 threads to the inch. One revolution of handle *O* makes $\frac{5}{100}$. The collar or ring *N* has five divisions, subdivided into ten each, or $\frac{10}{1000}$, a medium line between the fifths making half a hundredth.

The piece marked *Q* is a hard cast brass nut for *L*, and is soldered or sweat into *G*, as seen; and is tapped before being fitted to *G*. The outside is turned off on *L*, used as an arbor, or on any thread arbor of that pitch.

O can be made a larger diameter, and furnished with regular slide rest handle, if thought an improvement.

A. H. CLEAVES.

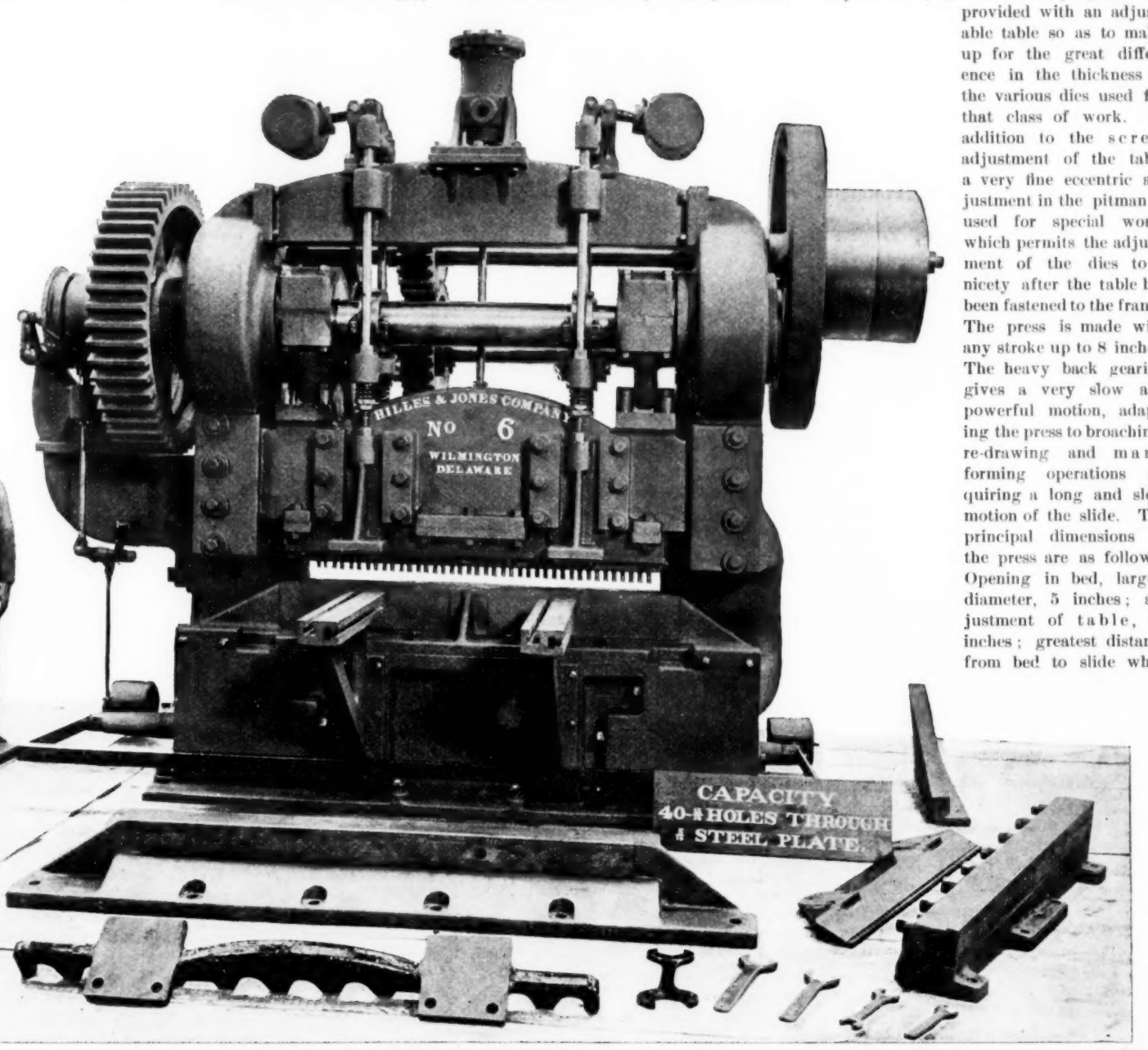
Multiple Punch and Gate Shear.

We present herewith an illustration of a machine which, besides being notable for its size and power, has other interesting features.

The machine in question has a capacity for punching forty holes $\frac{13}{16}$ inch diameter through $\frac{5}{16}$ inch plate at one stroke, and is well adapted for the punching of light plates as well, as there are two speeds, the faster one being intended for light plates requiring less power. The arrangement of the punch holders and die holders is exceedingly convenient, and it requires but a very few minutes to replace a defective punch or die. These parts are held in place to the sliding head and bolster piece by means of through bolts, and can be conveniently removed and shear knives substituted so that the machine becomes either a punch or shear.

The plate to be punched is automatically clamped in advance of the punches striking it, and is released after the punches have been withdrawn from it.

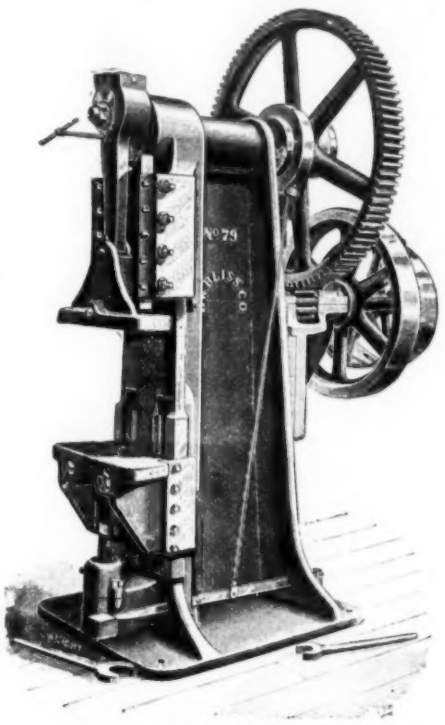
In addition to the vertical shearing arrangement there is an arrangement for bevel shearing for water pipe or tank work. This saves the use of a planer and makes a good calking edge. The sliding head is counterbalanced by steam or air pressure as shown in the illustration. Many of the parts are of



MULTIPLE-PUNCH AND GATE SHEAR.

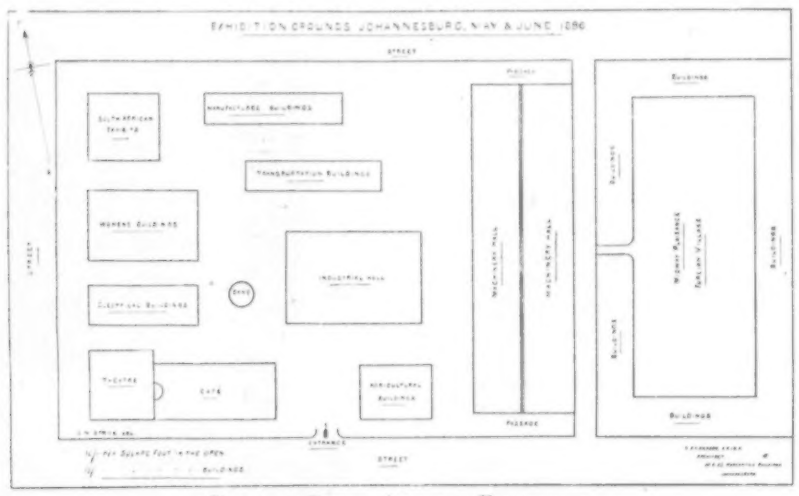
Bending Press for Bicycle Work.

We present herewith an illustration of a press made by the E. W. Bliss Company, of



Brooklyn, for the Pope Manufacturing Company. This machine is specially adapted for bending handle bars and tubing for bicycle work, and for that purpose it is provided with an adjustable table so as to make up for the great difference in the thickness of the various dies used for that class of work. In addition to the screw adjustment of the table a very fine eccentric adjustment in the pitman is used for special work, which permits the adjustment of the dies to a nicety after the table has been fastened to the frame. The press is made with any stroke up to 8 inches. The heavy back gearing gives a very slow and powerful motion, adapting the press to broaching, re-drawing and many forming operations requiring a long and slow motion of the slide. The principal dimensions of the press are as follows: Opening in bed, largest diameter, 5 inches; adjustment of table, 10 inches; greatest distance from bed to slide when up and at highest adjustment, 15½ inches; distance back from center of slide, 7 inches; weight, not geared, 7,200 pounds; weight, geared, 8,200 pounds; weight with special cut gearing, 75 to 1, and with friction clutch on back shaft (as built for broaching forgings and castings), 9,500 pounds; floor space over all, 48″x54″; hight to center of shaft, 80 inches.

We give below a reduced copy of the plan which is printed on the back of the blank application for space in the exhibition to be held at Johannesburg, South African Republic, beginning next May.



Plan of South African Exhibition.

No scale appears on it, and we are therefore unable to give size of any of the buildings. It is evident, however, that machinery is to be a prominent feature.

LETTERS FROM PRACTICAL MEN.

Green Sand, Dry Sand and Loam Molds.

Editor American Machinist:

The query often arises, what is the essential difference between producing castings either by green sand, dry sand or loam? Why use so many methods to arrive at the same results, *viz., castings?*

First, we will explain what sand, as used to make green sand molds, should be composed of. It should contain the largest proportion of silica possible, in connection with aluminum clays, sufficient to make it cohesive, with from 1 to 3 per cent. of magnesia. The presence of lime, if but ½ to 1 per cent., unfits sand for molding purposes, if sound castings are expected. Lime present as a carbonate at the temperature of melted iron, will give off carbonic acid gas that will work through the liquid iron, leaving small holes or air bubbles. The sand will vitrify and adhere to the face of the casting, making rough surfaces.

Sand for facing the mold that comes in contact with pattern, is often prepared with bituminous coal (sea coal) ground fine for this purpose. Coal is added in varying proportions from 1 to 12 down to 1 to 4, according to quality of the coal, and weight or thickness of the casting—lighter the work, weaker the preparation.

The sand is dampened with water, not too damp, but sufficient to render the sand cohesive enough to pack well when being rammed. While in this dampened or green condition the mold is poured. It is necessary that the sand should be to a certain extent open or porous after ramming, that steam, hot air and gases may find immediate exit, assisted by the judicious use of the vent wire, in connection with cinders or fine coke, their porosity providing reservoirs and avenues for the air and gases to escape into and through, so that the liquid metal may remain in a quiet, undisturbed state while the mold is filling, thus preventing boiling and scabbing. If either of the last mentioned happens it will jeopardize the possibility of a sound casting.

Different grades are selected to produce desired results. Fine, finer and finest are required for cotton and woolen machinery, small machinists' tools, stove plate and ornamental work. Medium, coarse and coarsest are selected for the heavier castings, engine beds, gear wheels, balance and fly wheels—castings, wherein thickness runs from 1½ inches to 12 inches, and more. The main and principal reason castings are made in green sand, is economy in time from pattern to delivered casting; also less fuel, etc.

To make the endless amount of small work by any other process would seriously curtail if not prohibit their present uses.

In Europe the preparation of sand for green sand molding is a matter of considerable manipulation and is costly. In America Dame Nature supplies it ready for use, and around the upper Hudson River and in New Jersey the finest sand in the world is found of every grade to suit the founder's art.

Dry Sand.—Dry sand, as the molder prepares it, is half free sand (coarse), half loam sand (same as used as coarse green sand), mixed with clay water with 10 per cent. to 20 per cent. of cheap molasses or sour beer. The sand is worked over (*cut up, in foundry parlance*) until uniformly tempered, but much damper, in fact, wet, compared to green sand tempering.

The mold is made in iron flasks, and less care is required in ramming or venting. When mold is dressed it is put in an oven and thoroughly dried if sound castings are expected.

Drying molds is done to insure soundness. Being in iron flasks the mold is strong, and prevents straining when casting long work vertical, and makes possible what in green sand would be impossible.

Loam molding is to make a mold of iron plates, bricks, and specially prepared loam or sand of from 25 to 33 per cent. of coarse, free sand with new strong molding sand mixed up with dilute clay water to the consistency of limp mud. This is used to put on the face of the mold between the bricks and pattern.

To lay the bricks a mortar is made from old molding heap sand or gangway scrapings, mixed with clear water into soft mud.

At intervals between courses of brick fine cinders or fine coke is placed in the interstices and under wide flanges or brackets, or from a core print, to lead off the vent.

When pattern is withdrawn or mold separated, or if swept up when loam is set or hardened by air drying, a solution of finely prepared thin loam called slurry is used to dress up the surface with, rendering the surface smooth and firm. After again becoming air-dried it is blacked and put in the oven to dry. If too large for the oven it is dried in the shop, but this is more expensive than by oven. When thoroughly dried it is placed in position where it will be put together to be poured, after being rammed up inside of a pit or curb, made of sheet iron, with provision made for vents, etc.

Loam or brick work is chosen for economy in pattern and flask making, and where but one or a few castings are wanted. There is less capital invested in flasks, and a few hours' pattern work will produce sweeps, nozzles, brackets, etc., that enable the foundry artist to produce the finest castings.

Loam work often shortens time between blue print and machine shop as compared with green or dry sand.

As fewer pattern parts are required a plate or two, more or less, a pile of soft brick, mud, and a sheet iron curb, constitute the adjuncts necessary to a loam mold.

The ever-present ghost that haunts the green-sand molder is vent, especially in large intricate work. If the melted metal does not fill the mold quietly, without disturbance, sound work will not be obtained; this fact cannot be emphasized too much.

By drying the mold trouble from vent is greatly lessened if not wholly eliminated. An apprentice asked an old green-sand molder the difference between green, dry and loam molding as to scientific points, etc.

"Vent, vent, my boy, is the essential difference. To know how, when, and where, to use the vent wire is one of the best evidences of good judgment in a green-sand molder.

"In dry sand, my boy, they prod here and there with a wire until it begins to kink, and when it gets kinky enough they throw it carefully among a lot of clamps or pig-iron. *That's dry sand.* Loam, loam, *they don't use it at all.*" (*It is evident the O. G. S. M. had a thread of sarcasm running through his make-up.*

L. C. Jewett.

Fastening Ropes to Crane Hooks—Over-accuracy—Disposing of Turnings—Accurate Drilling—Babbitting Jig.

Editor American Machinist:

Being in a shop not long ago when a load fell by reason of being improperly secured to the hook, I have thought that it might be well to show the proper way of making fast in such a manner as to get not only speed in making fast and in letting go, but absolute security as far as slip of the rope is concerned.

Any "sailor man" will tell you that the proper way of making fast in such case is by a "Blackwall hitch." This is made by

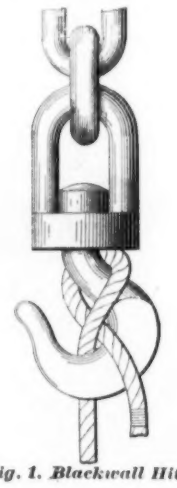


Fig. 1. Blackwall Hitch

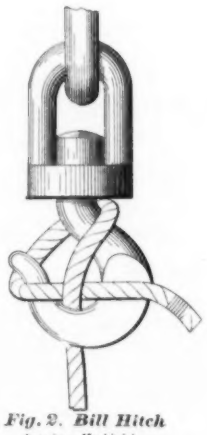


Fig. 2. Bill Hitch

American Machinist

Ropes for Crane Hooks.

laying the end of the rope across the hollow part of the hook (say, from right to left, as in Fig. 1), then taking the "standing part" (that is, *not* the free end), back over the neck of the hook (say from left to right) and bringing it down in the hollow of the hook (say from right to left), over the "free" part or end.

In making this hitch, the loop is *not* to be brought down into the hollow of the hook, but kept well up on the neck, as shown in Fig. 1.

To make a "bill hitch," which may be considered as slightly more secure than the "Blackwall," proceed just as for the "Blackwall," passing the free end of the rope along one side of the hook (say to the left), then around back of the neck (say from right to left), then bring it in front of the "bill" (as from left to right) and pass it under, between rope and hook, all as shown in Fig. 2. Or go about it the other way to; pass the free end under the standing part, from left to right, making a loop with the ends to the right; slip this over the bill and the neck of the hook (beyond the bill) so as to let the standing part pass into the throat to the left, and the free end lie to the right.

At the Centennial there was a platform scale exhibited, presided over by an attendant who weighed each person who wished it, and gave him or her a card on which his weight in pounds and ounces (and I am not sure but it was also in fractions of an ounce) was recorded as having been taken on the specified day, on the celebrated Blank Co.'s standard scales.

Now it happened that the scale-beam was notched only to quarter pounds. Still, it made the folks happy, and the matter seems to me now, as it did then, humorous, as an instance of over-accuracy. But it is not the only one across which I have come for a long time. For instance, in a gun shop (using "gun" in the sense of cannon) the boring is conducted very much like a religious rite, in the attempt to get absolute accuracy in diameter and absolute straightness of bore. There are about as many steady-rests as the law allows, in order to obviate the possibility of any lack of straightness in the finished bore. But when the piece is mounted on its trunnions, its long tube projects out unsupported, and the muzzle droops as a matter of course.

The only way to get a gun bore straight is to rotate the piece itself instead of the tool.

Just what to do with the turnings, and how to handle them most readily is a question which often agitates large establishments. They have a certain market value, where they are not disposed of in the shops that make them; but if they are mixed, that is, brass and iron, or even steel and iron together, they are neither usable nor salable. In the Baldwin Locomotive Works, where there are runways all over the concern, all the kinds of turnings—cast-iron, wrought-iron, steel and brass—are kept separate to start with; this being more readily done here, where piecework is the rule (clear down to labor) than where the other system prevails. The accumulations of each day are brought over in cars, each kind separately, to the second story of the boiler house, where there are shoots to convey them from hoppers marked plainly with the name of each kind of turning, to cars or wagons on the street level. This system saves time in handling the material, and permits its delivery from all over the shops (covering several city blocks) to a certain point, all of a kind together.

In the average shop when a workman has a hole to drill he makes his cross marks on a chalked surface with a scriber, then takes a prick punch, and marks a center (which may or may not correspond with the exact intersection of the cross marks), scribes a circle, takes his punch and makes four prick marks as nearly as he can on the circle, and then proceeds to drill the hole; drilling away these prick marks. The chances are about even up that he will not get the hole properly centered; also that if it is wrong that fact does not appear.

In the shops of Hugo Bilgram, the circle is scribed a trifle larger than the hole is to be, and deep enough not to be obliterated by the chips; no prick marks are made, and the workman is required to drill inside the circle, using the latter itself for the "witness."

This is much better to drill to than the four marks, made with greater or less (usually less) accuracy to represent where a circle is or was; and when the hole is drilled the circle, being still visible, shows whether or not the hole is in the proper position, and if it is not, how much "out" it is.

Where it is desired to have a definite distance between babbitted holes, as in a connecting rod, the method employed by the builders of the Westinghouse high-speed

engine insures absolute accuracy, while at the same time reducing the cost considerably. There is a jig made consisting of a horizontal slab having in it two vertical pins which are exactly as far apart as the desired distance between centers of the holes in the connecting rod; the diameter of the pins being practically that of the crosshead pin and crank pin. The rod, with the holes previously bored, is placed over these two pins and babbitted in position; the pins serving as mandrels to insure the proper diameter, parallelism, etc., of the holes. G.

[A similar plan is used in the construction of woodworking machinery, and has been referred to in these columns.—Ed.]

Picking Over Centers—Standard Center Angle.

Editor American Machinist:

Picking over centers, as most commonly conducted, I believe to be one of the most unsatisfactory jobs in the shop.

In many cases, of course, it is practicable to run the work in the back rest and true out the center with a lathe tool, and many times this is the quickest way. Sometimes the object is not to make the work run true, but to throw it out of true a certain amount, and sometimes the work is to be trued at a place where it is not practical to use the back rest.

Fig. 1 shows a center scraper that I have seen quite extensively used for scraping over centers. It is made with one edge or lip like a common flat drill, but with the other rounded so as not to cut in either direction. This tool, if held in line with the work, and otherwise handled correctly, will do the business, but I have found considerable difficulty in handling it correctly. If the countersink in the work fits the lathe center (as of course it should) and the center scraper is held out of line with the work (as it is likely to be) as in Fig. 1, it will be seen that considerable scraping can be done without changing the truth of the work at all—scraping that results only in lessening the wearing surface on the side scraped, which often causes the center to wear over at a time when such actions are considerably out of order. Of all the things that make a machinist weary, picking over centers with such a tool and trying results until his patience is about exhausted, and then, when he continues operations on the job, to find

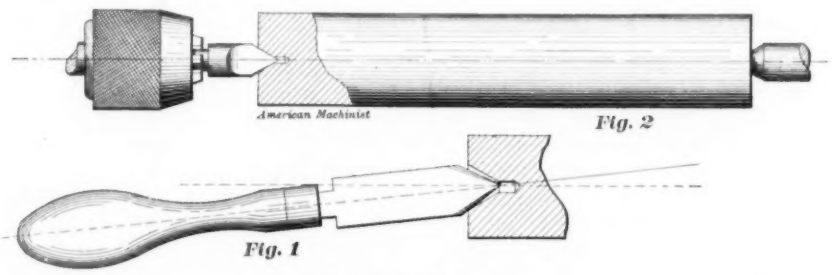


Fig. 2

Fig. 1

Shifting Centers.

the centers wearing over badly, and perhaps this at a time past a remedy, is one of the weariest.

Fig. 2 shows a plan that is often practicable, and when properly conducted (which is not quite the same as *properly conducted* when applied to Fig. 1) will produce satisfactory results.

I do not pretend to say that this is new, but one of those good things that deserves to be better known. Fig. 2 is only to represent a piece of work as ordinarily drilled and reamed in the lathe. The common halved center countersink is held in the chuck, but instead of revolving the countersink, the spindle should be locked, in any convenient way, with the flatted side of countersink (I prefer) vertical.

After the work has been marked (I generally use a chalk mark on the side toward which the center needs drawing) the center can be scraped over by working the shaft or work back and forth a little less than one-half revolution, while the tail-stock spindle is, as properly as possible, gradually tightened till the marked side is reached, and as gradually released for the same distance on the other side, when the work is returned to its former position and the operation repeated as many times as is necessary.

After a little practice, a person can draw over a center very nicely and quickly, taking a real shaving each time, and without getting the center out of shape, for after the center is drawn over sufficiently, the reamer can be used to round it so that annoying wear will not take place. A lathe with lever feed on the tail spindle is very handy for this purpose.

"Many men of many minds." This is the reason why we have so many center angles.

It is difficult to get all minds to favor the same idea. There are some worthy reforms that I never expect to see carried out for this reason, but such a very little matter as lathe center angles should not be allowed to work as much bother as it has in the past and is now doing. A shop that sticks to one angle, whatever that may be, does not experience so very much trouble until they undertake to repair some other shops' work. I once worked in a shop where they did not have any more bother with their neighbor's centers than with their own, for they had all angles from 60 degrees to 90 degrees, and the fellow who was not allowed to finish his work in the lathe he started it in, was considered in hard luck, and in cases where truth was expected the work was often in harder luck.

As other changes have taken place since the time when the machine shop was in a corner of the blacksmith shop, and the blacksmith's helper was boss machinist, this variety of center angles in one shop had to go.

I happen to know that on the earth to-day there are in use recognized as standard, by some people, center angles of 55 degrees, 60 degrees, 75 degrees, 80 degrees and 90 degrees, and I suppose all of these different people are ready to swear that their own center angle is the best.

In the shop where they used all angles they finally adopted 60 degrees because that seemed to work the best. The case here is much the same as in many other things in the shop. The tools that will stand the most carelessness are not always the most economical.

When Bill Smith tries to cut off a 2-inch shaft 4 feet long, in the centers, without back rest, and with one of his favorite cutting-off tools, and when that shaft breaks and wrecks both lathe centers, Bill is apt to favor 100 degrees as the proper center angle. Sometimes when Bill is squaring up the end of a piece of work, and he carelessly slacks up too much on the tail center and allows the work to go floating about on the point of lathe center, he is apt to favor a blunter center.

The case seems to be one of how much carelessness should be purchased at the expense of convenience and good work. I do not remember of ever seeing a 60-degree center broken that could not be fairly laid to carelessness, unless you might not class lack of judgment as carelessness. Of course it requires some judgment to know when to let up on that cutting-off tool just before the shaft breaks, but a careful man does not intend to work right down to the breaking point.

I think more lathe centers are wrecked in cutting off work than in any other way.

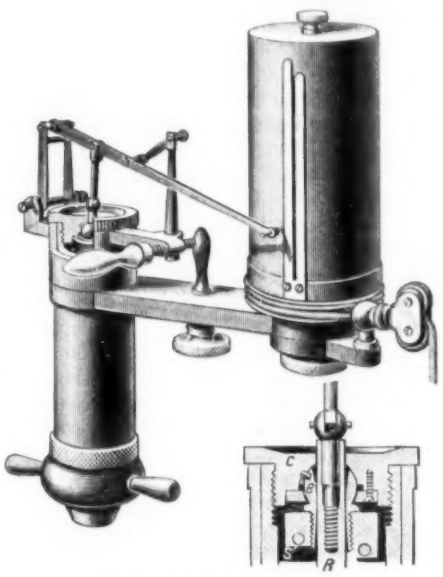
A Mechanic.

Rapid progress is being made in preparation for the exhibition to be held in Berlin next year, and a very large space is to be devoted to machinery and electricity, etc.

An Indicator Improvement.

As we all know, friction is one of the worst enemies of exact indicator practice, and much ingenuity has been expended in eliminating it.

Many makers and users of indicators believe that an important point is gained by the use of a universal (ball and socket) joint between the piston of the indicator and its piston rod; but owing to the fact that this as well as all other parts of the instrument moved by the steam pressure must be as light as it is possible to make them, this ball and its socket have been made smaller than considerations of lubrication, freedom from excessive wear and free working would alone indicate that they should be made.



Improved Indicator.

To overcome this difficulty, the arrangement shown in the accompanying engraving has been devised. It of course involves precisely the same principles as are involved in the previous constructions, and is believed to have all their advantages, but the joint, being located in the head where it has no movement, can be, and is, made as large as necessary to give ample bearing and durability.

The engraving shows the improvement applied to The Robertson-Thompson instrument, but it can be applied to any of the standard makes. It is made by the Hine & Robertson Co., 61 Cortlandt street, New York.

Mr. Charles Hine, a native of Virginia, a graduate of Washington High School, of the West Point Military Academy, and of the Cincinnati Law School, and until recently a lieutenant of the United States Army, is now a freight brakeman on the Chicago Division of the Big Four System. He has drawn his first month's pay, $60.20, has fallen into a cattleguard, and has smashed a finger and lost a nail already. He is of spare figure, and not too strong physically, so we hope that he will soon be qualified to graduate from his present school.

William Stackpole, a well-known maker of nautical and engineers' instruments (transits, levels, etc.), died at his home in Brooklyn on the 21st inst. at seventy-six years of age. He came to this country from Ireland at sixteen years of age, and has been connected with the business named above ever since. He was a fine and conscientious mechanic, and was highly esteemed by all who knew him.

Three patents issued, October 15th, to James W. Paige, Hartford, Conn., for a type-setting machine, the number of claims allowed being, respectively 130, 146 and 172. The application for the first patent was filed in 1882, for the second in 1887, and for the third in 1893.

When steel beams are carted through the streets they should be wrapped in paper to stop the infernal noise. How would it do to lay some pieces of old rope between them at both ends?

Some surprise is expressed in some quarters at the action taken by the Secretary of the Navy regarding inspection of the two torpedo boats that are to be built by the Herreshoffs. The usual practice of having an inspector constantly on duty has, it seems, been abandoned, on the ground that with such reliable firms as the one mentioned, the Cramps, or the Union Iron Works, such constant inspection is unnecessary, and is a needless annoyance and expense.

When the character of some of the inspecting that has been done is considered, it seems probable that the department will do just as well to dispense with it, but a difficulty will appear probably if any attempt is made to discriminate between the various firms that do such work. One firm will hardly be expected to concede that inspectors are needed in its own yards and not in those of a competitor.

A Report On Strikes.

In a recent report by United States Commissioner of Labor, Carroll D. Wright, much attention is given to the subject of strikes and lockouts in industrial establishments. The investigation of these extended over a period of seven and a half years, and involved 2,391,203 employes. In twenty-six leading manufacturing cities the loss in wages was $35,000,000, and to employers $29,000,000.

For the period covered by the report, out of the 46,863 establishments affected by strikes, success in their demands was gained by the employes in 20,397, partial success in 4,779 establishments, and failure followed in 21,687 establishments. Out of the 3,832 establishments having lockouts 1,883 succeeded in gaining their demands, 391 partially succeeded, and 1,558 failed. The leading cause of strikes was for an increase of wages, and these represented 25 per cent. of the whole number. Thirteen per cent. were for reduction of hours, 8 per cent. were against reduction of wages, 7 per cent. were sympathetic, 6 per cent. were for increase of wages and reduction of hours, 4 per cent. were against employment of non-union men, and 3 per cent. for a recognition of the union.

Spanish Gunboats for Cuban Waters.

Messrs. James and George Thomson (Limited) of Clydebank, Glasgow, are about to deliver seven gunboats to the Spanish government, which are interesting as having been built under exceptional pressure for the purpose of taking part in the suppression of the rebellion in Cuba. The names of the vessels are as follows: "Hernan Cortes," "Pizarro," "Vasco Nunez de Balboa," "Diego Velazquez," "Ponce de Leon," "Alvarado" and "Sandoval." The vessels are not all of the same type, but have displacements ranging from 300 tons to 100 tons, and the speeds range from 13 to 12 knots. The vessels are being delivered fully armed with quick-firing guns of the Maxim type, the largest gun having a caliber of 3 inches, and firing a shot of 14 pounds in weight. The contract for the vessels was signed on July 11th; the first vessel was launched on August 24th, and the last of the seven on September 20th. The first, the "Hernan Cortes," was ready for delivery on September 11th, and the whole seven gunboats were completed on October 1st, or ten days within the contract time. Owing to the intervening of the Glasgow Fair holidays from July 11th to July 22d, the actual construction of the "Hernan Cortes" was not commenced until the 22d. The vessel was therefore constructed in 45 working days, or little over seven weeks. The company accepted the work under heavy penalties, but have easily met all the requirements of the contract; nor has this work been expedited at the expense of the other ships under construction.—*London Times.*

A press dispatch dated 18th inst., announces that a strike of tool makers took place at the bicycle shops of Toledo, Ohio, on the 17th for a 10 per cent. advance in wages, and that nearly 5,000 men had been made idle by it. Such a strike is, so far as we know, unprecedented. In the dispatch it is stated that the Manufacturers' Association declined to accede to the demand and closed their shops.

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CONTENTS.

PAGE.

Some Historical Notes Relative to the Invention and Development of the "Slide Rest." By W. F. Durfee... 861
The Competition of Women... 862
Bicycle Tools—V. By Hugh Dolnar... 863
A Novel and Complete Steam Jacket... 864
Design for a V-Threading Tool—Lead Lapping. By A. H. Cleaves... 864
Multiple Punch and Gate Shear... 865
Bending Press for Bicycle Work... 865
Letters from Practical Men: Green Sand, Dry Sand and Loam Molds. By L. C. Jewett.... Fastening Ropes to Crane Hooks—Over-Accuracy—Disposing of Turnings—Accurate Drilling—Babbitting Jig. By G.....Picking Over Centers—Standard Center Angle. By A Mechanic... 866, 867
An Indicator Improvement... 867
A Report on Strikes... 867
Spanish Gunboats for Cuban Waters... 867
Is Ignorance Ever Innocence?... 868
The Outflow of Skilled Mechanics... 868
Information About Patents... 868
Steering by Throttle... 868
Death of Ex-Governor Ames... 869
Questions and Answers... 869
American Machinery in Bombay... 869
Sea-Going Coast-Line Battleships Nos. 5 and 6. 869
New Hub and Cone-Making Machine... 870
A New Coal Calorimeter—I. By R. C. Carpenter... 870
Obsolete Machinery—Shorter Hours. By W. H. Booth... 871
Japanese Vessels Building in England... 872
Gunmakers Protest... 872
Launch of the "Nashville" and the "Wilmington."... 873
New Catalogs... 873
Manufactures... 873
Machinists' Supplies and Iron... 874

Is Ignorance Ever Innocence?

This may not strike anyone as a question having any mechanical bearing, and, therefore, as not coming within our province to discuss, yet we have little doubt that it has at different times shaped itself in the mind of many a mechanic, and in connection with mechanical affairs. It is not as easy a question to answer as at first sight it might seem to be. The expression is common enough that "he is not to blame because he did not know any better." Ignorance of the civil law is allowed to excuse no one, and human law would seem to be of the same pattern with the law of the universe. Ignorance begets folly, and, judged by the severity of the punishment which the natural course of events usually inflicts upon folly, it would seem that there can be no greater crime than ignorance. There are, of course, different grades or conditions of ignorance, and where the answer to our question might be easily enough rendered in one case, it might be very difficult of solution in a second, and in a third case the answer might be completely reversed. There are cases where a man does not know, knows that he does not know, tries to learn and is learning. There are other cases where, as before, the man does not know and knows it, but does not try to learn. Then, again, there are those who, still as in the first instance, know that they do not know, but cannot find the way of learning. There is still another class whose ignorance is of the densest, yet is exceeded by the density of their ignorance of their dense ignorance and incompetence. All of these classes find more or less numerous representation among the workers in the shops, but the worst of it is that they are all to be found also among the proprietors or managers of mechanical or manufacturing establishments, and the sifting process seems to be much slower and less effective when working upon the material at the top of the pile than upon that at the bottom. While we are so exercised over the scarcity of skilled and reliable mechanics in the shops, and are consulting as to the remedy, it would seem to be also a proper time to call attention to the lack of knowledge and judgment in those who are in the positions which make their deficiencies more potent for evil than those of the individual worker in the shop. The consequences, or, as some would read them, the punishments, for ignorance in high places can no more be escaped there than elsewhere. The degrees of culpability vary greatly, but we are tempted to doubt if we always weigh them justly, when those we hold to be most innocent are capable of producing the most derangement. So far as it may be true of the poet, it is also true of the mechanic that he is born and not made. There is such a thing as a natal gift of mechanical aptitude without which eminent success in mechanical lines is scarcely possible. A middle class of mortals are capable of being trained to the performance of the average mechanical operations, and these, without any discoverable manifestations of mechanical tendencies, probably comprise the majority of men in the shops. A third class there is also who display absolute inaptitude for mechanical ideas of any kind, and cannot be trusted with the performance of any responsible mechanical operations. Men of this class are not drawn to the shop by their own tastes; some of them are driven into it by circumstances, and suffer there and are suffered for a time, but they generally get weeded out by the process of the survival of the fittest, and hence it happens that some of those who could not have been tolerated in the shops to run the lathes, and ram the flasks, and weld the connecting rods, become the capitalists over the shops instead of the botches in them. It need not be said that their capacity for mischief in such positions is inversely in proportion to their mechanical instincts. By the attraction of taste and fitness which draws the best natural mechanics into the direct activities of the trades, and the repulsion that is continually driving away those who have no mechanical qualifications, it comes to pass that in this most mechanical age mechanical fitness and ability is more scarce than it should be among men of wealth and power who have control of all great affairs. No question would seem to-day to be more pressing than that of the mechanical education of millionaires so that they may not be continually inveigled into unmechanical schemes, and so that they may know a good thing when they see it. The question with which we started it is not necessary to answer in haste, but it may be kept to think over.

The Outflow of Skilled Mechanics.

Some shop proprietors and many of the trade papers are worrying over the scarcity of skilled, or, rather, of highly skilled workmen, and they are making the usual suggestions for providing a more constant and adequate supply in the future. The situation is not, apparently, a very serious one, as we do not hear of any work going undone or being turned out in bad condition, and if the demand for elaborate and accurate machinery should largely increase, we have no doubt that means would be secured for satisfying it.

The remedial measure generally proposed and advocated is in the wider dissemination and more extended scope of the trade schools, so that those who enter the trades will be better prepared at the beginning, and will have greater promise of excellence and skill all the way as they advance. Now we would be the last to say a word against the trade schools; but, as we regard the present problem, the trade schools are not an important factor in it. The trouble largely in the mechanical world, and especially in the machine shop, is that the skill that is developed in the shop is not retained there. It is continually flowing off at the top, and we are inclined to think that the outflow is at a constantly accelerated velocity, and this there is no proposition to check in any way. There may be some suggestion of remedy in the better education of those who enter the shops, but between the entrance of the apprentice and the full development of the excellent and highly skilled workman a long period elapses, so that relief by this means must be, at best, remote; and, after all, it may tend rather to exaggerate the complaint than to relieve it. For if we are by this means, or by any means, eventually to provide workmen better qualified for the more difficult and responsible operations in the shop we are equally enhancing their qualifications for the positions outside of the shop which are continually enticing them away. Probably few persons realize how many positions outside of the shop are filled by machinists drawn from the shops, and generally better filled than they could be by any men without the machine-shop training. If anyone of mature years has been cognizant of the personnel of a machine shop for a quarter of a century it will be strange if he does not know of several of the best workmen who have permanently left the shop for more remunerative positions, and principally because of their qualifications as machinists. What we are saying does not involve any comparison of the relative skill of the machinist with that of the allied trades, such as the blacksmith, the molder, the patternmaker, the boiler maker, or any other. These all require skill that is only developed to full excellence by good mental and physical powers under years of discipline; but none in these trades, it will be readily admitted, are subject to the external enticements that beset the machinist. Many good machinists become engineers of the large factory engines, or of the electric light and railway plants which are now so numerous, in fact, the presumption is that these men are machinists. The electric stations have drawn a great many men from the machine shops for other positions in connection with the operation and maintenance of their machinery. So in all the places where machinery is employed, which is everywhere, machinists are constantly finding permanent place, and the total combined drain of machinery upon the trade is enormous. And then it is to be remembered that skill is a mental much more than it is a physical manifestation, and the study of machinery gives the mind a better exercise and discipline than geometry has always been assumed to do, as it embraces geometry and much more, and the graduate of the machine shop is well trained to compete with men as they are found in every line of business, whether mechanical or not. And so men go out of the shop into lines that are little associated with machinery, and still are often successful. When depressions of business occur many good men are forced out of the trade into other lines of activity and never return to it again, and it is when the resumptions of the wasted activities occur that we hear most of the scarcity of skilled workmen. Obviously steadiness of employment and wages that will enable the men wisely resist the offers that beset them from the outside will keep many more of them in the trade, and there will then be less complaint of the lack of skilled men in the shops.

Information About Patents.

Our correspondent who is writing the series of articles on bicycle manufacture had in his manuscript quite an extended and detailed notice of the patents granted to and controlled by the Indiana Novelty Manufacturing Company, whose processes of rim manufacture were recently described by him; which detailed statement we replaced by a general one to the effect that numerous patents had been taken out on both rims and processes of manufacturing them; which we consider sufficient.

We have before this defined our position with regard to publishing statements respecting patents that have been taken out on machines or parts of machines described and illustrated by us, and we believe that, all things considered, it is better—that we shall come nearer doing justice to ourselves, to our readers and to all concerned, by uniformly avoiding such detailed or specific mention of patents, and confining our articles strictly to what they purport to be, *i. e.*, a description of construction and method of operation.

It only occasionally happens that we know just to what extent a machine is covered by patents, and often we do not know whether there are any patents upon it at all or not. In such cases we *must* omit mention of patents, and if we do and then mention them in other cases the conclusion might be drawn that no patents had been taken out in cases where we failed to mention them.

It may be well to warn our readers that in this series of articles on bicycle manufacture we shall, of course, illustrate and describe many things that are patented, but that we cannot undertake to give full information regarding patents.

It can be depended upon generally that any line of manufacture is more or less protected by patents, and it is pretty generally understood, we think, that anyone who proposes to go into a given line of manufacture must first thoroughly examine the ground. The competition of one so indiscreet as to omit taking such a precautionary measure is not generally to be much feared.

If we were to undertake to give information regarding such things—information that would be of any real value to anyone, we would be going outside of our field for the benefit of a very few of our readers, and would then not do the work as well as it would be done by a competent patent attorney engaged to make a specific investigation.

Steering by Throttle.

The unfortunate rudder of the American Line steamer "St. Louis" asserted itself by a complete breakdown in a gale on the last easterly voyage. The "St. Louis" left New York on October 16th, and the rudder was broken when about 800 miles from Southampton, the steering for that distance being accomplished by the twin screws. This latest break is reported to have been at the bottom or step of the rudder, while the

former occurred near the top. The present rudder, it will be remembered, was taken from the "St. Paul." This second disabling accident and the circumstances of it would make it appear that the defect in the rudder is in the design rather than in the workmanship.

Death of Ex-Governor Ames.

Ex-Governor Ames, of Massachusetts, who died on October 22d, aged 64 years, was one of us. As a former governor of the same State, Governor Banks, used to say of himself, he was a graduate of "a college with a bell on the top and a water wheel underneath." Oliver Ames had a common-school education, and at the age of sixteen his father put him into the shovel works, where he worked side by side with the other men until he was twenty. Then he was in Brown University for two years, and after that returned to the factory, and later became its superintendent. He was not a kid-gloved manager, but was familiar with the smoke of the forge, and worked as hard as any of his men. He was of an inventive turn and of untiring industry, and was a valuable addition to the experts employed in improving the plant and its product, inventing several processes for expediting the work and reducing the labor cost. Later his time and energies were fully occupied in the disentanglement of his father's complicated business interests, and in the duties of political life.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet. We cannot undertake to answer questions in "next issue." This department is usually crowded, and questions must wait their turn to be answered. Neither can we undertake to solve mechanical or engineering problems, and send answers by mail.

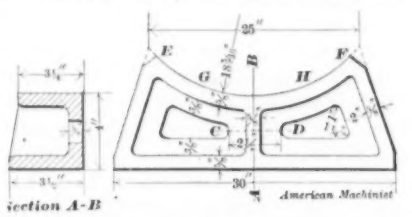
(387) J. W., Detroit, Mich., writes: Kindly give rule for computing the capacity of fan blowers, also for computing their horse-power. *A.*—We cannot give you rules applicable to all cases. The best way will be to procure catalogs from the manufacturers, who generally give the capacity of the fans and blowers built in their works, and the power required to drive them.

(388) W. C., Jamestown, N. Y., writes: Please let me know what kind of material to use for making a form or metal mold into which I can pour composition, and thus make small castings in the same mold from time to time. *A.*—A cast-iron mold will answer your purpose, provided it is arranged or divided into separate pieces as the form of the casting may require for taking it out of the mold.

(389) G. C., Bellville, N. J., writes: Please let me know if gasolene in contact with a steam coil is dangerous. I want to put a steam coil into an air-tight tank and warm the liquid while it is being converted into gas. I do not want to try the experiment unless I am sure that the heat from the live steam will not cause an explosion. *A.*—Do not try the experiment—it is very dangerous.

(390) L. P. M., Philadelphia, Pa., writes: The following is an extract from W. S. Auchincloss' book treating on the "Link and Valve Motion:" "Suppose a cut-off were required at a piston position of 0.93 of the stroke, or a crank angle of 150 degrees . . . When the eccentric stands at right angles to the crank, the exhaust closes and release commences at the extremities of the stroke, consequently, if the eccentric be moved ahead 30 degrees, not only will the cut-off take place 30 degrees earlier, or at a crank angle of 120 degrees instead of 150 degrees, but the release as well as the exhaust will take place 30 degrees earlier, or at the 150-degree crank angle." Now kindly explain to me through your columns why we should not have a crank angle of 180 degrees instead of a crank angle of 120 degrees as stated. *A.*—The author does not mean to move the eccentric 30 degrees ahead of the crank angle of 150 degrees as you seem to understand it, but to move it 30 degrees ahead of a crank angle of 90 degrees. It should also be remembered that in the case under consideration a rocker is used between the valve and the crank shaft. Looking at the problem in this light, we believe you will have no difficulty in understanding it.

(391) O. G., Philadelphia, Pa., writes: Kindly give me a rule for computing the greatest safe load a saddle, such as shown below, will carry. *A.*—In problems of this kind there is difficulty in determining the distribution of the load, because in practice the saddles are not finished, and therefore the load may bear at the middle point only, or at the outer points, or at several points along the arc. We should therefore assume that the whole load is carried by the section at *C D*, and that the supports at *E* and *F* simply steady the load. The area of



Section A-B

the section at *C D* is 2.81 square inches, and assuming that each square inch can support with safety 10,000 pounds, then the whole load which the saddle can support is 2.81 × 10,000 = 28,100 pounds, or 14 tons. The area of each of the supports at *E* and *F* need to be only one-half the area of the section *C D*. If the load should bear on the points *G* and *H* then the ribbed portion under these points should be considered as beams, and their strength investigated by the fundamental formula given in answer to Question 376, page 829 current volume.

(392) W. W., Buda, Ill., writes: In two of my text-books, under the definition of "atmospheric pressures," it is stated that 14.7 or 15 pounds is equal to one atmospheric pressure, and that two atmospheric pressures are equal to 60 pounds, and four equal to 120 pounds. I always thought that two atmospheric pressures were equal to 60 pounds. I cannot see how, or by what rule the above pressures advance as they do. Kindly explain. *A.*—This seems to be a case of careless or hasty reading on your part. One atmospheric pressure is equal to 14.7 pounds, or in round numbers 15 pounds per square inch, hence two atmospheric pressures are equal to 15 × 2 = 30 pounds per square inch, and not 60 pounds as you have always thought to be the case; and four atmospheric pressures are equal to 15 × 4 = 60 pounds per square inch. One atmospheric pressure will support a column of mercury 30 inches high, hence two atmospheric pressures will support a column of 30 × 2 = 60 inches; and four will support a column of 30 × 4 = 120 inches. You will find that your text books give the pressures equal to 60 inches and 120 inches, and not 60 pounds and 120 pounds. 2. I inclose a circular from a gas engine builder, and to my idea he is away off and is working on old ideas that have been exploded more times than the gas in his engine. You will see that the engine takes gas at both ends of the cylinder. Kindly give your opinion on the matter. *A.*—We see nothing wrong with this engine. Gas engines of this type are made, and have their advocates. Further than this we cannot criticise any particular type or make of engines. 3. Please inform me how to compute the horse-power of a rotary engine of the type shown in sketch. *A.*—Multiply the number of revolutions per minute by the mean travel of that part of the slide which is acted upon by the steam by the area of this part in square inches, and by the steam pressure per square inch, and divide this product by 33,000; the result will be the horse-power. Do not waste your time in attempting to make an engine of the type as shown on your sketch to run with any satisfactory results.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 852.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Patent Solicitor. J. G. D. Mack, Madison, Wis.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Engrs. should investigate the Korting Condenser. Obtain Catalog from A. Alier, 109 Liberty St., N. Y.

Marine Iron Works, Chicago, builders of steam yachts and marine machinery; catalogs free.

A book for superintendents. "Hawkins' Calculations" (descriptive), $2.50 postpaid. Catalog free. Theo. Audel & Co., 91 Liberty street, N. Y.

Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N.Y.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

Key Seaters for any length of hub or width of keyway. New, handy machines. Mitts & Merrill, 913 Tilden street, Saginaw, Mich.

Thin emery wheels, for cutting slots, etc., a specialty. The Tanite Co., Stroudsburg, Pa.; 161 Washington street, New York; 139 East Pearl street, Cincinnati, Ohio.

"Practical Drawing," by J. G. A. Meyer; used by engineering schools in lieu of text-book; the set of 92 papers sent to any address in the United States for $5. American Machinist, 203 Broadway.

American Machinery in Bombay.

The U. S. Vice-Consul, at Bombay, India, writes us that "American" machinery is not introduced here to any extent excepting in the case of sewing machines in which the Wheeler & Wilson and Singer Co.'s seem to have made a great success. The manufacture of cotton is the chief business in the manufacturing line in this part of India. In Bombay City and Island there are 70 mills and in other parts of the Bombay Presidency 29 more, making a total of 99 mills. These have 2,563,728 spindles, 24,284 looms, employ 89,315 hands, and consume annually 3,054 660 cwts. of cotton. There are also a large number of cotton presses and ginning mills in this presidency. I mention these facts to show you in what line the greatest amount of machinery is used.

Sea-Going Coast-Line Battleships Nos. 5 and 6.

The following is taken from a circular defining the chief characteristics of two sea-going coast-line battleships of about 10,000 tons displacement, for the U. S. Navy.

In the act making appropriations for the naval service for the fiscal year ending June 30, 1896, provision is made for two sea-going coast-line battleships, to cost, exclusive of armament, not more than four million dollars ($4,000,000) each. One of the battleships to be built on or near the coast of the Pacific Ocean, or in the waters connecting therewith, provided that if it shall appear from the bids received that the said vessel cannot be built at a fair cost at the place fixed therefor in the proposal, the same may be built elsewhere in the United States.

In the cost of armament is included, besides the guns, ammunition, etc., all armor of turrets or barbettes, gun shields, etc., directly pertaining to the protection of the guns and loading positions only.

These vessels are to be built under the provisions of the act of August 3, 1886, entitled "An Act to Increase the Naval Establishment," as to materials for said vessels, their engines, boilers and machinery, save that in all their parts said vessels shall be of domestic manufacture. The contracts under which the vessels are to be built are to be in accordance with said act, except that no premiums are to be offered. It is further stipulated in the act of March 2, 1895, that the vessels may be constructed of steel or other metal, or of alloy.

The Department in advertising for these vessels to be built by contract, will invite proposals under two classes, viz.:

Class 1.—For the construction of the hull and the machinery, including engines, boilers and appurtenances, equipment, except anchors and chains, and for the installation of ordnance and ordnance outfit complete in all respects, in accordance with plans and specifications provided by the Secretary of the Navy.

Class 2.—For the construction of the hull and the machinery, including engines, boilers and appurtenances, equipment, except anchors and chains, and for the installation of ordnance and ordnance outfit complete in all respects, in accordance with plans and specifications submitted by the bidders.

Bidders may, if they so desire, adopt the plans and specifications of the Department for the hull or machinery, or any part of either, and embody them in their plans and specifications to be submitted with their proposals. . . .

All designs of machinery must fulfill certain general requirements of the Department, regarding which all necessary information will be supplied on application to the Bureau of Steam Engineering.

Any design of the vessel submitted must be in sufficient detail, accompanied by such plans, specifications and calculations as to enable the Department to readily determine its value and that it fulfills the herein-mentioned general requirements; the calculations to include complete calculations of weights, displacement and range of stability under the conditions of normal displacement, deep load displacement, and light displacement; such calculations as will determine the extent of injury above and below the armored deck, which may be suffered while retaining satisfactory buoyancy and stability, and also such calculations as will demonstrate the satisfactory strength of the whole structure. . . .

It is contemplated, in the Department's design, to drive the vessels by twin screws. The engines to be of the vertical triple expansion type, two in number—one on each shaft—and in two compartments. The boilers are placed in four compartments, and are five in number, three of them being double-ended, and two single-ended. . . .

The following elements and qualities are obtained and provided for in the Department's design, and their equivalent must be obtained and provided for in all designs submitted.

(1). The speed to be maintained at sea for four consecutive hours, under conditions to be prescribed by the Secretary of the Navy, to be not less than an average of 16 knots an hour.

(2). The hull is to be of steel, not sheathed, with double bottom and close water-tight subdivision.

The arrangements of decks above water to provide ample freeboard and berthing accommodations.

It is contemplated to fit two military masts with fighting tops, to carry no sail. The boats to be stowed clear of the blast of the guns; but two lifeboats to be so carried as to be rapidly lowered under all conditions of weather.

(3). The protection of the hull against injury to the water-line region is to be afforded by means of a side armor belt of a maximum thickness of not less than 15 inches, and a mean depth of 7 feet 6 inches. The belt to extend at least from the stem to the after barbette, and to maintain the maximum thickness throughout the engine and boiler spaces; from thence forward it may be tapered gradually to a thickness of 4 inches. The transverse armor at the after end of the belt, and just forward of the boiler, will be not less than 8 inches in thickness. Barbettes for 13-inch guns will have armor not less than 15 inches thick, except in rear where it will be reduced to 12 inches. The turret port plates to be 17 inches in thickness, the balance of armor plating 15 inches thick. The ship's side, from the armor belt to the main deck, will be protected by not less than 5 inches of steel armor, from barbette to barbette. Coal is to be carried back of a portion of this 5-inch casemate armor.

An armored deck is to extend throughout the length of the vessel. Where this steel deck is worked flat the thickness will not be less than 2½ inches, and where worked with inclined sides the slopes will be 3 inches in thickness. A cellulose belt is to be fitted along the sides the whole length of the ship.

A conning tower of not less than 10 inches in thickness, having an armored communication tube not less than 7 inches in thickness, will be carried in a suitable commanding position, the tube extending to the armor deck and affording protection to voice tubes, bell wires, etc.

The 8 inch gun turrets will be superposed on the 13-inch turrets, and the armor will be not less than 11 inches in thickness on the port plates, and 9 inches elsewhere.

In wake of the 5-inch guns on the main deck is to be continuous armor 6 inches thick extending between the turrets. Further protection is to be afforded by splinter bulkheads between the guns, 2 inches thick, extending from deck to deck.

Protection is to be afforded the smaller guns by shields and extra side plating. . . .

(5). The torpedo outfit to consist of five torpedo tubes, eight torpedoes, and suitable allowance of gun cotton for mines and miscellaneous purposes. The torpedo tubes will be placed two on each broadside and one in the bow.

(6). Provisions and small stores are to be carried for three months. Distilling apparatus and evaporators will be fitted for fresh water supply, the allowance of water to be carried to be sufficient for fifteen days, besides water for sanitary purposes. Clothing, contingent and small stores to be carried in sufficient quantity for the service of the ship for one year.

(7). It is contemplated, as previously stated, to drive the vessel by twin screws. The engines to be of the vertical, triple-expansion type, two in number, in two separate compartments. The boilers to be of the cylindrical double-ended pattern, three in number, and two single-ended boilers, to be placed in four compartments. The weight of propelling machinery, including water and stores, should not exceed 1,100 tons.

Alternate machinery must fulfill the general requirements before laid down.

(8). The total coal bunker capacity must not be less than 1,210 tons, stowed in bunkers without trimming by hand, of which at least 410 tons are to be carried at normal displacement.

(9). The electric lighting plant should consist of three units, each unit having engine, dynamo and combination bed plate, and each dynamo having a rated output of 400 amperes at 80 volts. The total weight of the three units complete should not exceed 31 500 pounds. The total weight of the whole electric installation, including dynamos, engines, bed plates, all fittings, wirings and stores, and four search lights, should not exceed 44 tons.

GENERAL DIMENSIONS OF DEPARTMENT DESIGN.

Length on load water line (normal displacement).....	368 ft. 0 ins.
Molded breadth at load water line.....	72 " 0 "
Mean draft at normal displacement.....	23 " 6 "
Normal displacement (about)..	11,500 tons
Total coal capacity, loose stowage.....	1,210 "
Coal carried at normal displacement	410 "

. . . . . .

If, on trial, the average speed shall equal or exceed a speed at sea of 16 knots per hour for four consecutive hours, the vessel will be accepted in so far as the speed is concerned. If the speed falls below 16 knots and exceeds 15 knots per hour, the vessel will be accepted at a reduced price—the reduction being at the rate of $100,000 per knot speed below 16 knots. If the speed falls below 15 knots per hour, the vessel will, in the discretion of the Secretary of the Navy, be rejected or accepted at a reduced price mutually agreed upon between the Secretary and the contractors. In case of rejection, any money that may have been paid to the contractors, on account, shall be refunded.

The time that will be allowed for the construction of these vessels will be three years from the date of signing the contract.

New Hub and Cone-Making Machine.

We present herewith an illustration of a new hub and cone-making machine made by The Lodge & Davis Machine Tool Company, of Cincinnati. While it has all the essential features of a special machine, yet it is not special, and can be changed from a hub machine into a regular standard screw machine in less than ten minutes. It is adapted to forming and drilling hubs, making cones, cups, axles, etc., of bicycles. The head stock is friction back-geared, and has a two-step cone for a 5-inch belt. The spindle is made of crucible steel, ground and journaled in bronze boxes with provision for taking up wear. It is furnished with the Parkhurst automatic chuck and feeding attachment, which enables the operator to feed, grip and release the bar without stopping the machine.

The hub rest is a massive affair, taking a long bearing on the bed, preventing chatter and insuring a smooth finish. It is provided with two heavy uprights, having dovetailed grooves supporting the front and rear tools. The rear tool does the roughing, and is serrated to break the chips. It is started in ahead of the front tool, but by reason of the feed screw being of a coarser pitch at the front end, the finishing tool gradually feeds in ahead of the roughing tool, giving the hub a smooth finish.

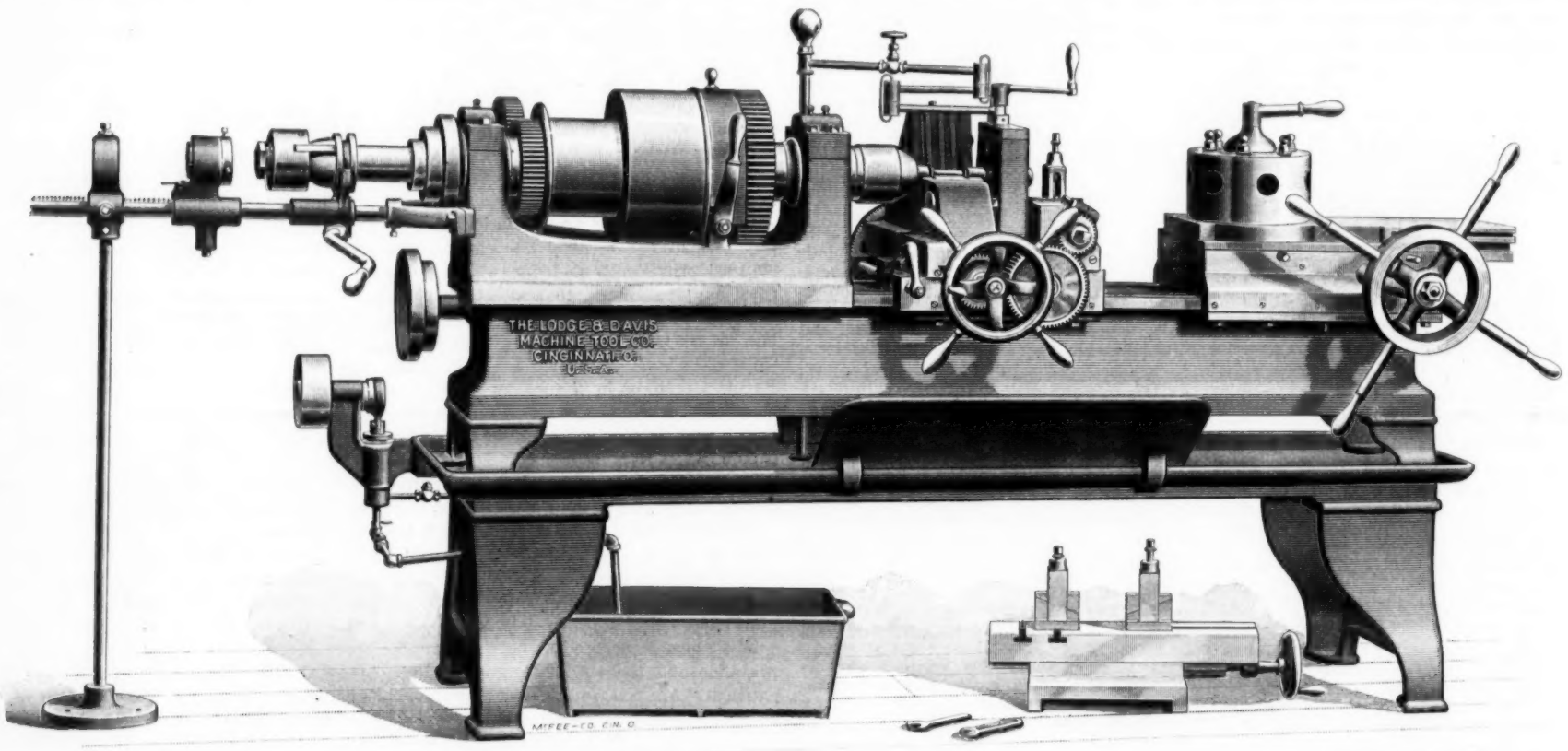
The cutting-off rest is mounted on the same base of the hub rest, is provided with automatic feed, and so set as to cut off the first hub, while the third one is being formed, thus consuming no additional time in the cutting-off operation.

The steady rest or guide for the bar is placed between the hub rest and the cut-off rest. It is operated by a right and left-hand screw, and will grip stock from ¼ inch to 2½ inches diameter.

The cutting tools are made of the best steel, the full length of the hub, and are sharpened by grinding straight across the face, without altering their form. They are constantly flushed with oil by a plunger pump, driven by a belt from the countershaft.

The power feed to the hub rest, turret and cutting-off rest is derived from the main spindle by cones, and is disengaged automatically.

Each machine is furnished with set of tools for forming front and rear hubs, cut-off rest, and two collets to suit size of stock for front and rear hubs.



Hub and Cone Machine.

A New Coal Calorimeter—I.*

By R. C. Carpenter.

During the last year we have had in use in the laboratories of Sibley College an instrument for determining the heating value of coals, which may be of interest to members of the society, and which is described in the following paper.

The general appearance of the instrument is shown in Fig. 1, a sectional view of the interior part is shown in Fig. 2, from which it is seen that, in principle, the instrument is a large thermometer, in the bulb of which combustion takes place, the heat being absorbed by the liquid which is within the bulb. The rise in temperature is denoted by the hight to which a column of liquid rises in the attached glass tube.

In construction, Fig. 2, the instrument consists of a chamber, No. 15, which has a removable bottom, shown in section in Fig. 2, and in perspective in Fig. 3. The chamber is supplied with oxygen for combustion through tube 23, 24, 25, the products of combustion being discharged through a spiral tube, 29, 28, 30.

Surrounding the combustion chamber is a larger closed chamber, 1, Fig. 2, filled with water, and connecting with an open glass tube, 9 and 10. Above the water chamber, 1, is a diaphragm, 12, which can be changed in position by screw 14, so as to adjust the zero level in the open glass tube at any desired point. A glass for observing the process of combustion is inserted at 33, in top of the combustion chamber, and also at 34, in top of the water chamber, and at 36, in top of outer case.

This instrument readily slips into an outside case, which is nickel-plated and polished on the inside, so as to reduce radiation as much as possible. The instrument is supported on strips of felting, 5 and 6, Fig. 2. A funnel for filling is provided at 37, which can also be used for emptying, if desired.

The plug which stops up the bottom of the combustion chamber carries a dish, 22, in which the fuel for combustion is placed; also two wires passing through tubes of vulcanized fiber, which are adjustable in a vertical direction, and connected with a thin platinum wire at the ends. These wires are connected to an electric current, and used for firing the fuel. On the top part of the plug is placed a silver mirror, 38, to deflect any radiant heat. Through the center of this plug passes a tube, 25, through which the oxygen passes to supply combustion. The plug is made with alternate layers of rubber and asbestos fiber, the outside only being of metal, which, being in contact with the wall of the water chamber, can transfer little or no heat to the outside.

The discharge gases pass through a long coil of copper pipe, and are discharged through a very fine orifice in a cap at 30.

The instrument has been so designed that the combustion can take place in oxygen gas having considerable pressure, but in practice we have found that very excellent results have been obtained with pressures of 2 to 5 pounds per square inch, and these have been commonly used in our determinations.

The instrument holds about 5 pounds of water, and is large enough for the consumption of 2 grams of coal.

The temperature of the discharged gas was, in our first experiments, measured by a thermometer in the attached cup *V*, Fig. 1; later experiments prove this unnecessary, and the form in Fig. 2 has been finally adopted, as being simpler to construct and more convenient to use.

Before the instrument was constructed, it was the intention to calibrate the scale so as to give the results directly in heat units; and for this purpose a thermometer with cup and special appliance for stirring was to be employed. It was afterwards found out that the value of the scale could be obtained much more simply by burning different weights of pure carbon, and thus obviate any necessity for complicated corrections due to the specific heat of the various parts of the instrument.

By the combustion of different weights a calibration curve, co-ordinating B. T. U. and weights of fuel, is obtained, which is essentially a straight line for the instrument described.

*Abstract of a paper presented at the Detroit meeting of the American Society of Mechanical Engineers.

In case there is any change in the character of the heating or absorbing surfaces, a new calibration can readily be made at any time by preserving some of the coke first used in calibration.

The value of 1 pound of pure carbon has been determined so accurately, and repeated so many times, that it provides a very convenient and accurate standard. This value is ordinarily taken as 8,080 calories, or 14,540 B. T. U. The latest value, as determined by Berthelot, is 8,136.6 calories, 14,646 B. T. U., a number above ¾ of 1 per cent. higher than determination by Fabre and Silbermann and various other observers.

PROXIMATE ANALYSIS OF COAL.

We have found it quite easy to make a proximate analysis of one sample during the time that another is burning in the calorimeter. Many of the operations which are necessary in the one case are helpful in the other, and the two results give, in a measure, a check on each other.

The method of making a proximate analysis has been presented to the society in a paper by Mr. Eckley B. Coxe, past president of the society.

The method which we have employed has been very similar to that described, although it has been modified somewhat to suit our conditions. The method which is employed to such an extent for the proximate analysis of fuels in chemical laboratories, that it may be considered in many respects a standard, is given in the following concise directions.

"DIRECTIONS FOR PROXIMATE ANALYSIS.—COAL AND COKE."

The sample should be finely pulverized in a mortar, and then thoroughly mixed.

Moisture.—Place the weighed sample (about 1 gram) in a porcelain crucible, and dry in an air bath for one hour, at a temperature between 105° and 110° C. Weigh as soon as cool. Loss is moisture.

Volatile Matter.—Weigh about 1½ grams of the undried pulverized coal, place it in a platinum crucible and cover tightly. Heat it for 3½ minutes over Bunsen burner (bright red heat), and then immediately, without cooling, for 3½ minutes over blast lamp (white heat). Cool and weigh. Loss, less the moisture, is volatile matter.

Fixed Carbon.—If a coke be formed in the preceding operation, make a note of its properties, color, firmness, etc., then place the crucible, with cover removed, in an inclined position, and heat over Bunsen burner until all carbon is burned, *i. e.*, to constant weight. The combustion may be hastened by stirring the charge from time to time with a platinum wire. Difference between this weight and last weight is the fixed carbon.

Ash.—Difference between last weight and weight of crucible is the ash.

TOTAL SULPHUR IN COAL AND COKE.

Prepare a fusing mixture by thoroughly mixing two parts calcined magnesia with one part anhydrous sodium carbonate. Determine the sulphur in the mixture.

Thoroughly mix 1 gram of the finely pulverized coal with 1½ grams of fusing mixture. Heat over an alcohol lamp, in an open platinum or porcelain crucible, so inclined that only its lower half may be brought to a red heat. The crucible should not be over ½ or ⅔ full, and the heat should be gentle at first, to avoid loss upon the consequent sudden escape of volatile matter, if present in large amount. Raise the heat gradually (it must not at any time be high enough to fuse the mixture), and stir the contents of the crucible every five minutes with a platinum wire. The oxidation of the carbon is complete when ash becomes yellowish or light gray (about one hour). Cool crucible, add 1 gram pulverized $NH_4 NO_3$ to the ash, mix thoroughly by stirring with a glass rod, and heat to redness for five to ten minutes, the crucible being covered with its lid.

Cool, digest the mass in water, transfer the crucible contents to a beaker, rinse out the crucible with dilute warm H C l, dilute solution in beaker to about 150 c. c., acidulate with H C l, and heat almost to boiling for five minutes. Filter and precipitate the sulphuric acid in filtrate by Ba Cl_2 in usual manner.

Phosphorus.—If present, it will be found in the ash. Ignite about 10 grams of the coal in a large platinum crucible, and determine the phosphorus in the ash in the usual manner. (See Fresenius, p. 741.)

In the mechanical laboratory it has not been practicable to determine, during the past year, either the sulphur or phosphorus. These quantities are not usually of importance, unless the coal is destined for certain uses, where these ingredients would be harmful, and as the determination would require much more time than that of all other processes in the proximate analysis, and including the calorimetric determination of heating value, it was not considered advisable to introduce it.

The operation followed in the mechanical laboratory in the proximate analysis of coal has differed principally from that described, first, in the use of larger samples; and second, in the use of porcelain instead of platinum crucibles. The use of larger samples was undertaken principally for the reason that we could weigh, with sufficient accuracy for engineering purposes, on a Brown & Sharpe scale reading to ten-

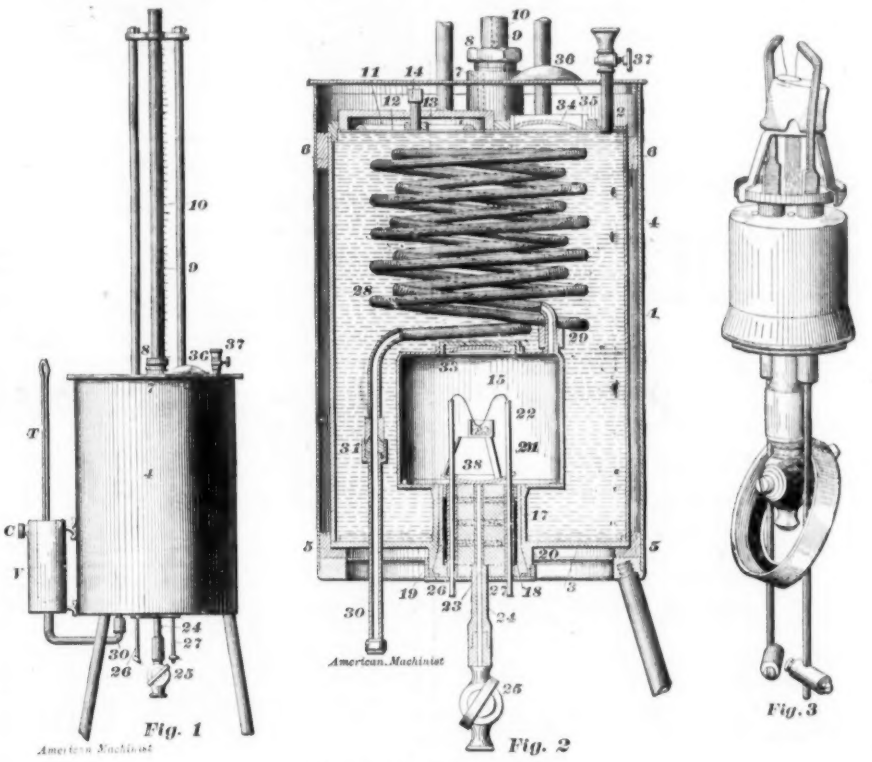


Fig. 1 Fig. 2 Fig. 3

NEW COAL CALORIMETER.

thousandths of a pound, and were not obliged to resort to chemical balances.

Where the quantity was as small as 1 gram, the weights had to be taken on delicate chemical balances. These balances, while very accurate, are extremely sensitive, and require the utmost care and patience in order to get results which are correct within 1 per cent.

In the substitution of porcelain for platinum crucibles a great many experiments were made, and it was found that in every case the results obtained with the porcelain crucibles were substantially in accord with those given by the platinum, and the writer could not find, on consultation with chemists at the university, that there was any theoretic objection to the use of porcelain. In fact, it was generally regarded as superior, for several reasons, of which may be mentioned, less first cost and less liability of injury by the fusing of particles in the coal when over the blast lamp. In the determination of the volatile matter the same general directions were followed as given, but instead of subjecting the fuel to the heat for any definite length of time, the conclusion of the operation was known by change of color in the flame. The flame would be yellow or yellowish so long as any volatile matter remained; it would then die down, and when the carbon commenced to burn would be decidedly blue. The operation was always stopped when the blue flame appeared. The crucible employed is made of Royal Meissen porcelain, and provided with cover. It has a capacity of half an ounce, and costs seventeen cents. During the operation the cover is fitted snugly in place, and the gases escape around the edge, and are kept burning.

The percentage of ash is determined by weighing the residue which remains after combustion in the calorimeter. The burning of the fixed carbon requires a long time when performed in the air, but in the calorimeter the operation is performed very quickly and very accurately, so that the total time required to determine the proximate composition and also the heat values of a sample of coal need not exceed twenty or thirty minutes, for a person familiar with the operations.

METHOD OF USING THE CALORIMETER.

The method of using the calorimeter, supposing that oxygen is available for combustion, and that an electric current can be obtained for lighting the coal, is as follows:

1. Select an accurate sample by a system of quartering, which shall commence with a very great amount, if possible, and finally terminate with a very small fraction of a pound. (See paper by Mr. Coxe.)

2. Reduce to powder by grinding in a mortar, or in a mill, as explained by Mr. Coxe, sufficient coal for several samples.

3 Introduce the sample into a small porcelain or asbestos cup and weigh accurately. This operation will usually have to be performed on a fine chemical balance.

4. Introduce the sample into the calorimeter, (*a*) start the oxygen gas flowing; (*b*) fire the charge, which should be done by pressing on a key; (*c*) at instant coal is lighted, throw off the current and note the reading of the scale. By noting this, after firing, the correction for heat from electric wire is made by simple subtraction.

5. Watch the combustion, which will usually require about five minutes for each gram of coal, and when completed note the scale reading. The water on the scale will rise about 15 inches for the amount of coal usually burned.

6. To correct for radiation note the amount the water in the column has fallen for the same time as required for combustion; add this to the former reading to get the total number of heat units.

7. Divide the value as shown on the scale by the weight in pounds of the sample burned. The result will be the value in B. T. U. of 1 pound of coal.

8. Remove the dish in which combustion took place, weigh it carefully with and without contents. If the combustion has been perfect the difference of these weights gives the ash.

Wipe combustion chamber dry for another determination.

9. To prepare for another determination, remove the calorimeter from the outside case, and immerse in cold water, care being taken to prevent any water entering the oxygen tubes or combustion chamber.

This method is preferable to emptying the calorimeter and adding fresh water each time, since the air, which is always present in water, will affect the results, and is a difficult element to remove. The operation of cooling takes but a few minutes, and is easily performed.

The cup in which combustion takes place in all determinations at Sibley College has been, up to the present time, made by wrapping sheet asbestos around the end of a cylinder about one-half inch in diameter, the cup shape being preserved by gluing. This cup was then introduced into the fiercest flame of a blast lamp until all combustible matter was burned out, and until no further change in weight could be made by heating. This cup has, so far, proved very successful; its non-conducting qualities have permitted combustion to take place up to its very edge, and no trouble whatever has been experienced in securing perfect combustion, with a powdered sample either of anthracite coal, coke, or bituminous coal.

Obsolete Machinery—Shorter Hours.

By W. H. Booth.

For some years past, during which the English iron industry has suffered in common with that of other countries, a certain class of papers has persistently attributed every example of successful foreign competition to the benign influences of lower wages abroad, and has continually been crying out that the English workingman ought to bring his ideas down to the same level. The notion up to which these papers write being evidently that a man ought to work himself to pieces, and be satisfied to go from work to sleep, and back to work, without intermission.

All this sort of nonsense has had its share in nursing some of our old-fashioned works into the comfortable conviction that all that was possible had been done to meet competition except to reduce wages, and with the idea of finding out something of the small wages paid to German ironworkers, and impressing this fact upon the idle and foolish Englishmen, there was lately sent over a deputation to German iron works, and they have certainly collected some very valuable information. Without going into detail it may be said that the wages paid in the best German iron works are by no means so much lower than the English rate of wage, while in one department, that of plate-rolling, they were actually found to be higher. The fact seems to be that in trying to get hold of outside trade Germany has found it needful to make her workmen comfortable and to pay good wages. The report strikes at the root of the arguments which have so long formed a staple dish with a few of our papers, who can no longer advance low wages in Germany as the cause of any failure here to meet the market.

What, however, has been shown is, according to the various members of the deputation, a very high development of the engineering of the successful German iron works, and the verdict is, practically, that in place of grumbling, our iron works must cease to expect good returns from plant and machinery that has long since paid for itself.

The weekly hours of work in this country are in some trades 56; but in engineering works from 54 down to 48; this latter figure now becoming standard, and having been found in several large works to give better results than 54 hours.

In trades involving continuous work, as in the chemical trade, a double shift of 12 hours each has been the custom, but recently the largest works in the country changed from two shifts of 12 hours each to three of 8 hours, and this, of course, involved an addition to the number of men of 50 per cent.

For the 8-hours day the same pay was given as for the 12-hours day. This involved raising the pay sheet by the same 50 per cent. Now what was the result? Simply that the wages cost per ton of production was actually reduced, the quality of the product was improved, and there was an obviously palpable difference in the gait of the men when leaving work in favor of the shorter hours, and an improvement in sobriety as one might expect. These results are, very naturally, exceedingly welcome to those who believe in short hours properly occupied; but it is very difficult to drive such ideas into the skulls of some men, even when the journals they represent have *always* been on the wrong side of such questions. The important part of the whole business is that the report of the deputation simply knocks the bottom out of all the arguments used of late as to the necessity of low wages and long hours, and leaves the employers face to face with the necessity of bringing themselves into line with modern knowledge and practice.

My own experience has long convinced me of the superiority of short hours of work properly filled up, and has taught me that those who call out most for long hours and low wages seem to draw the line at themselves and confine themselves to dispensing advice rather than to acting on it in person. The successful German works are, if the report of the English delegates is to be taken as reliable, those conducted on most humanitarian lines. One works has paid as much as 25 to 30 per cent. for 15 years, whose chief object has seemed to be the care of the workers and the spending money on improvements and machinery.

Clearly the lesson to be learned is not to go on too long trying to do modern work with old machinery, but to use machinery up to its fullest capacity and wear it out before it has had time to become obsolete, and to pay workers sufficient to enable them to retire in comfort before they also become obsolete.

London, Eng.

Japanese Vessels Building in England.

Harold Frederic, the London correspondent of the New York *Times*, says:

An old Newcastle engine builder friend of mine, who yesterday signed a contract with the Japanese for a one hundred and fifty thousand dollar job, tells me curious things about the way the Japanese are laying out the money that they expect to get from China. They have two big battleships on the stocks here, ordered before the war and now nearly finished, and they are completing arrangements with British builders for three more of the same size, and also for eleven armored cruisers and some torpedo catchers. All are to be hurried forward with the utmost dispatch. Meanwhile, a Chinese commission of eight experts and officials here in Europe, is charged with the task of examining the various shipyards and marine models, and of recommending where orders for a new Chinese Navy may be placed to the best advantage. The Japanese have money and are paying one-third down at the signing of the contract, one-third when the engines are put in, and the final third at the launching and delivery, but no one will trust the Chinese at all, and they must pay in full before the work is begun. The Japanese make no bones in saying among shipbuilders that they are going to whip Russia off the Pacific.

Gunmakers Protest.

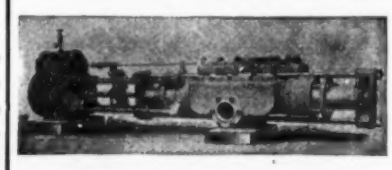
Captain Sampson, Chief of the Bureau of Ordnance, recently ordered 50 rapid-fire guns to be manufactured at the Washington Navy Yard. The Driggs Ordnance Co. has protested against this, and comments upon the matter as follows:

It has been announced at the Navy Bureau of Ordnance that 100 rapid-fire landing guns of the Fletcher pattern are to be constructed at the Washington Navy Yard—50 now and 50 others at an indefinite date.

This order is a result of the competitive trial held last November, in which three guns were entered, viz., the Driggs-Schroeder, Hotchkiss, and Fletcher. The last-named gun (the one which the Ordnance Bureau has now decided to adopt) was not only reported upon by the board as vastly inferior to the others, but, as a gun mechanism, proved a complete failure. Contrary to all fair understanding of competition the Fletcher gun, after the trial, was removed to the Washington Navy Yard, and then remodeled, repaired, and subjected to two private trials in the absence of competitors. In both of these trials it failed to meet the requirements and adverse reports were submitted by the trial board. As far as can be ascertained, this gun has not yet been made to work satisfactorily, and it is now at the Washington Navy Yard in a damaged condition.

Bids were recently invited by the Navy Department for the construction of 100 guns, the Driggs Ordnance Company bidding on its Driggs-Schroeder gun, which is a standard arm and which passed a satisfactory trial, and the Hotchkiss Company bidding on the Fletcher, the patents on which it controls. It has been ascertained that the Driggs Ordnance Company's bid was below that of the Hotchkiss Company and was acknowledged as not excessive, and yet the order was denied the Driggs Company.

THE DEANE OF HOLYOKE MINING PUMPS.



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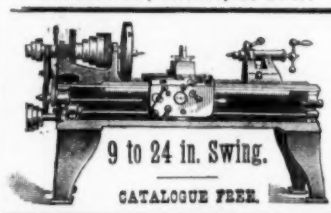

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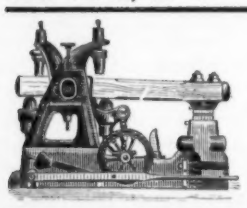

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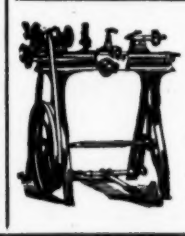

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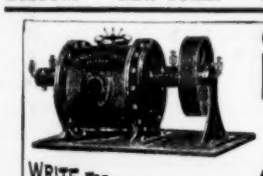

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The Driggs Ordnance Company claims that in view of having distanced its competitors both on the proving grounds and in prices, the contract should rightfully have been awarded it, and has therefore appealed the case to the Secretary of the Navy. From what can be learned this is a most extraordinary case, and how the Bureau of Ordnance reached its present decision is a mystery, for it does not appear to be in accordance with public policy to force private ordnance establishments into competition with the Government shops and thus close plants that might, in time of necessity, be of great service to the Government; nor is it in the line of economy to attempt to manufacture a gun which has already failed when tried practically, no matter how fair may be its promises in theory, when a well-tried gun, meeting all the requirements, may be obtained.

Launch of the "Nashville" and the "Wilmington."

The gunboats "Nashville" and "Wilmington" were launched at Newport News on October 19th, according to program. The double launch and the circumstances determining it are unique. The two boats were built upon the same slip, and tandem to each other, and the interval between the two launches was only about an hour and a quarter, this time being required to grease the ways again, to remove the debris of the first cradle, and to see that everything was all right. The boats were built in this way in order to take full advantage of the services of the traveling crane, which is now so important an agency in all constructive engineering. The yard of the contractors, The Newport News Shipbuilding Company, is provided with two slips, each long enough for the construction of ships up to 500 feet in length, and both fully commanded by a crane traveling between them and capable of lifting 60,000 pounds at the end of an arm 125 feet long. As the combined length of the "Nashville" and "Wilmington" is only 485 feet, they could easily be constructed upon the one slip, leaving the other for other use; the steamer "Newport News" for the Plant Line having been recently launched therefrom.

Samuel Rodman, Jr., late 1st Lieut. 2d U. S. Artillery, has established himself at 84 Adams street, Chicago, Ill., as an expert in matters connected with the use of high explosives, and will undertake to determine their value for various purposes, and will make tests of safes and vaults, either after or during their construction to determine their value as a protection against burglars.

The third general meeting of the Society of Naval Architects and Marine Engineers will take place in the auditorium of the American Society of Mechanical Engineers, 12 West 31st street, on Thursday and Friday, November 7th and 8th.

The battleship "Indiana," an account of whose preliminary trial trip we gave last week, subsequently on her official trial attained a speed of 15.61 knots for four hours.

If you feel within yourself a desire to expand your usefulness in behalf of the machine interest of this country; if you are a bright, aggressive man who can tell his story to advantage and address business men; in short, if you think it possible to earn more money, write or call on the Treasurer of the AMERICAN MACHINIST, and he will show and explain a method which might make you a more useful man and add largely to your income.

NEW CATALOGS.

There are three sizes of Standard Catalogs, 9" × 12", 6" × 9" and 4½" × 6". We recommend the 6" × 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

The W. & S. Hydraulic Machinery Works, 204-210 East 43d street, New York, send us an illustrated price list of improved hydraulic jacks. This shows by perspective and sectional engravings various forms of jacks for various purposes, for which such tools are used. It is 8"x5⅜", and is sent to those interested on application.

The Armstrong Bros. Tool Co., 78 Edgewood Ave., Chicago, Ill., send us a small catalog illustrating and describing their improved tool holders of various forms, which have been the subject of illustrated articles in our columns. They publish also a number of letters from well-known machinery builders, testifying to the value of the tools. The catalog is 3½"x6¼", and is sent to those interested on application.

The Universal Telephone Co., Indianapolis, Ind., have issued a pamphlet which illustrates and describes their telephone apparatus which is especially adapted to the requirements of those who wish to establish such communication between the various departments of manufacturing or industrial establishments. The apparatus is fully illustrated, and there are a number of fac-simile letters from users of it, relating their experience. The catalog is sent to those interested on application, and is 4½"x5⅝".

Landis Bros., Waynesboro, Pa., have issued a book, which, though it partakes largely of the nature of a catalog, is called "A Treatise on the Construction and Use of Universal and Plain Grinding Machines." In this are illustrated and described grinding machines which have been at various times presented to our readers, and in addition some machines which we have not shown. The book will be found of interest to those who have to do with grinding operations, and is sent to those interested on application. It is standard size 6"x9".

MANUFACTURES.

The Laurens (S. C.) Cotton Mill Co., which has recently been organized, has decided to increase its capital stock from $200,000 to $250,000.

The Glaziers have recently enlarged their mill at South Glastonbury, Conn., and will soon put in new carding and spinning machinery.

E. E. Titus, of Petersburg, Va., has begun erecting a new machine shop, the main building being 30x130 feet in size, with an L 20x50 feet, and the foundry 40x60 feet.

The Latrobe Steel Company, of Philadelphia, Pa., has been incorporated with a capital of $1,000,000, by Marriott Smyth, Howard Wood and others. The company will operate the Latrobe Steel Works, at Derry, Pa.

The Diamond Machine Co., of Providence, R. I., are to make an exhibit of their ball-bearing grinder and other machinery for the use of bicycle manufacturers at the Stanley Show, to be held in London, England, in November.

It is announced that, at the conclusion of an interference contest in the Patent Office, a patent has recently been issued to the Cleveland Twist Drill Co., Cleveland, Ohio, on the grip socket for driving twist drills, which has been the subject of an illustrated description in our columns.

The Marine Iron Works, Clybourn & Southport avenues, Chicago, Ill., have recently contracted to build two steam yachts for use as excursion boats on Chautauqua Lake. These boats will be 51 feet long and 10-foot beam, and will be shipped by rail *via* Chicago & Erie Railway, to Jamestown, N. Y., on special cars.

The Berlin Iron Bridge Company have lately completed for Wilmot & Hobbs, of Bridgeport, Conn., a new rolling-mill to take the place of the one lately destroyed by fire. The main mill is 126 feet wide and 200 feet long, with engine and boiler room attached in a separate wing, 54 feet wide by 90 feet long. The construction is entirely fire proof, no wood being used about the building, so the risk from fire is absolutely eliminated. The roof covering is The Berlin Iron Bridge Company's patent anti-condensation corrugated iron.

It is announced that the Huyett & Smith Mfg. Co., of Detroit, Mich., has transferred its business and all interest connected with it, to the American Blower Company. It is stated in this connection that the personnel of the new company will remain the same, with the exception of the withdrawal of Mr. W. D. Smith, vice-president, and that as Mr. Huyett has not been connected with the company for more than ten years, the name is in reality meaningless. The new company will devotes its attention to the same line of business, namely, hot blast apparatus, dry kilns, fans, blowers, engines, etc.

The Lodge & Davis Machine Tool Co., of Cincinnati, Ohio, report a remarkable increase in sales of their line of bicycle machinery, and especially their larger sized screw machines and patent hub machine. They have received orders for this latter machine from the following concerns during one week recently: J. F. Meyers Mfg. Co., of Hamilton, Ohio; Howard Watch and Clock Co., of Boston, Mass.; Waltham Mfg. Co., of Waltham, Mass.; Century Cycle Mfg. Co., of Shelbyville, Ind.; Bellis Cycle Co., of Indianapolis, Ind.; and the Columbus Bicycle Co., of Columbus, Ohio, and the Munger Cycle Co., of Indianapolis, Ind.

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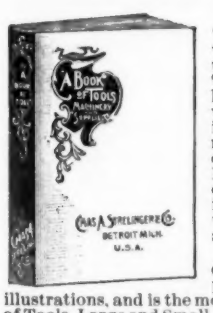

Many readers of the "AMERICAN MACHINIST" who have seen our advertisement of "A Book of Tools" in other journals, have perhaps wondered why we didn't advertise it in this. There was a good reason; we didn't have enough books to go around. Have just printed a new edition, making 38,000 copies, and for a time at least will have enough to go around.

"A Book of Tools" is a catalogue. It contains 556 pages, upwards of 2,000 illustrations, and is the most complete Encyclopedia of Tools, Large and Small, Machinery, Big and Little, ever issued. Is invaluable to any one who buys or uses this class of goods, and will be sent post-paid to any address upon receipt of 25 cents in stamps.

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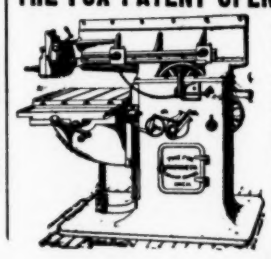

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SECOND-HAND MACHINE TOOLS.

ENGINE LATHES.

25 x 12, Fifield, Compound Rest.
15 x 6 Blaisdell, Compound Rest with turret.
13 x 6 Ames, Rise and Fall Rest.
11 x 4 Manu Lathe.
16 x 7 Maker Unknown.
16 x 8 Blaisdell, Plain Rest.
18 x 10 Flather, Plain Rest.
18 x 10 Blaisdell, Plain Rest.
28 x 20 Perkins Compound Rest.
37 x 14 Maker Unknown.

PLANERS.

16 in. x 16 in. x 4 ft. Hendey.
20 in. x 20 in. x 4 ft. Nashua.

SHAPERS.

10 in. Juengst, Crank.
12 in. Juengst, Crank.
10 in. Wood and Light, Traverse Head.
18 in. Putnam, Traverse Head.
15 in. Juengst Friction Shaper.

DRILL PRESSES.

10 in. No. 1 Slate's Sensitive.
6 Spindle Quint, Turret.
No. 2 Three-Spindle, Garvin.
No. 2 Four-Spindle, Pratt & W.
No. 4 Four-Spindle, Garvin.
21 in. Kirkhoff, W. & L. B. G.
24 in. Blaisdell, Wheel Feed.
24 in. Aurora, Back Geared.
30 in. Pond, Back Geared, Power Feed.
9 ft. Holly Mfg. Co., Radial.

SCREW MACHINES.

No. 1 Garvin, Wire Feed.
No. 5 Brown & Sharpe.
No. 1 Garvin, Plain.
No. 2 Brown & Sharpe, Plain.
No. 2 Garvin, Wire Feed.
16 in. x 5 ft. Reed Turret Chucking Lathe.

MILLING MACHINES.

No. 2 Pratt & Whitney, Lincoln.
No. 2 Garvin, Plain.
No. 0 Garvin Universal.
No. 2 Garvin Duplex.
No. 2 Garvin Hand.
No. 4 Brainard Standard Universal.
Putnam-Lincoln.
No. 2 Pratt & Whitney, Lincoln.

Also, a large list of other machines. Write for complete list, detailed description and prices.

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LAIGHT & CANAL STS., NEW YORK.
Also, 51 North 7th St., Philadelphia, Pa.

FOR THE NEXT 30 DAYS

we offer our entire stock of machine tools at SECOND-HAND prices. This is a BONA-FIDE offer and the OPPORTUNITY of the YEAR.

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BEFORE REMOVAL

At Phœnix Iron Works, Trenton, N. J.

15 in. x 6 ft. Engine Lathe.
22 " 12 " " "
29 " 13½ " " "
26 " 20 " " "
37 " 30 " " "
71 " 18 " " "
52 in. x 20 ft. Engine Lathe.

10-36 and 50 in. Drills.
Portable Drill.
36 in. x 14 ft. Planer.
12 in. Shaper Traverse Head.
Gear Cutter, 54 in.
Milling Machine.

10 ft.-16 ft. Vertical Boring and Turning Mill, Cranes, Blower, Boiler Rolls, Punch and Shear, etc.

Send for full list and prices.

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One New Delamater Duplex Steam Pump, 8 x 5 x 10, brass-lined, 4" suction, 3" discharge; a bargain. Other sizes, new and second-hand. **COOKE & CO., 163 & 165 Washington St., N. Y.**

Second-Hand Machinery.

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2 10 in. x 5 ft. Foot & Power.
2 11 in. x 5 ft. Power only.
1 15 in. x 6 ft. Dustin.
1 16 in. x 8 ft. Flather.
2 18 in. x 8 ft. Flather & Prentice.
3 18 in. x 8 ft. Lodge & Davis.
2 21 in. x 10 ft. Pratt & Whitney.
1 27 in. x 10 ft. Dustin.
1 28 in. x 12 ft. Blaisdell.
2 30 in. x 14 ft. Lincoln.
1 32 in. x 13 ft. Bement Triple Geared.
1 22 in. x 10 ft. Niles.
1 24 in. x 10 ft. Niles.
1 79 in. Driving Wheel, Bement.
1 48 in. x 18 ft. Gay & Silver.

PLANERS.

3 48 in. x 32 in. x 6 ft. Pond, two heads.
1 48 in. x 32 in. x 8 ft. Pond, two heads.
3 24 in. x 24 in. x 6 ft. W. & L., one head.
1 28 in. x 28 in. x 8 ft. Gay & Silver.
1 32 in. x 32 in. x 10 ft. W. & L.
1 38 in. x 38 in. x 10 ft. Aldrich.
1 32 in. x 10 ft. Open Side.
1 60 in. x 60 in. x 22 ft. Hepworth.

DRILLS.

3 22 in. Back Geared.
2 25 in. " & P. F., Snyder.
1 34 in " " Harris.
2 No. 1½ Niles Radial.
2 Suspension Drills.

MILLING MACHINES.

1 No. 1 B. & Sharpe.
2 No. 13 Garvin.
1 No. 15 "
1 No. 2 " Hand, and others.

SHAPERS.

9 in., 12 in., 13 in., 15 in., 20 in.

MISCELLANEOUS.

1 18 in. P. & W. Screw Machine.
1 20 in. x 6 ft. Flather "
2 Horiz. B. & D. Machines.
1 Cylinder Borer, P. & A.
1 30 in. Motor Gear Lathe
1 Double Punch and Shear.
1 30 in., Pulley Lathe.
1 Hydraulic Riveter.
2 Bolt Cutters.
1 Nut Tapper.
1 20 in. Pattern Lathe.

Also large stock of other tools. Send for List.

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136 and 138 Liberty St., NEW YORK CITY.

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Brooklyn, N. Y.
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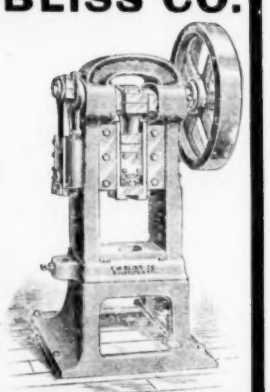

SECOND-HAND MACHINERY.

1 86 in. x 18 ft. Lincoln Triple-Geared Engine Lathe.
1 84 in. x 24 ft. Wilmarth " " " "
37 in. x 42 in. x 10 ft. Fifield Lathe, C. Rest and P. C. Feed.
34 in. x 47 in. x 16 ft. Pond Mach. Tool Co. Lathe, C. Rest and P. C. Feed. Has 24 in. Chuck.
32 in. x 8 ft. D. W. Pond Lathe, C. Rest and P. C. Feed.
29 in. x 10 ft. Perkins Lathe, P. Gib Rest and P. C. Feed. Has 17 in. Chuck.
26 in. x 17 ft. D. W. Pond Lathe, C. Rest and P. C. Feed.
26 in. x 22 ft. " " " " " " " Has 21 in. Chuck.
24 in. x 10 ft. Pratt & Whitney Lathe, C. Rest and P. C. Feed.
20 in. x 8 ft. Fifield Lathe, C. Rest and P. C. Feed.
20 in. x 11 ft. Wm. Sellers Lathe, C. Rest and P. C. Feed. Has 16 in. Chuck.
20 in. x 8 ft. Pratt & Whitney Lathe, C. Rest and P. C. Feed.
18 in. x 9 ft. " " " " " " "
16 in. x 10 ft. Bullard Lathe, Plain Gib Rest.
14 in. x 6 ft. S. Ashton Hand Lathe, Plain Gib Rest.
Lot Speed Lathes Assorted.
60 in. x 60 in. x 26 ft. L. W. Pond Planer.
38 in. x 38 in. x 10 ft. " " "
36 in. x 36 in. x 10 ft. D. W. Pond "
32 in. x 32 in. x 10 ft. " " " 2 Heads.
26 in. x 25 in. x 6 ft. Pond Mach. Tool Co. Planer.
15 in. x 15 in. x 16 in. Whitcomb Crank Planer.
12 in. Stroke, Warren Traveling Head Crank Shaper.
15 in. " Hendey Friction Shaper.
Semi-Universal Warren Radial Drill, 48 in. Arm.
Full " Bickford " " 72 in. "
32 in. D. W. Pond Upright Drill, B Gears and Power Feed.
30 in. Prentice " " " " "
28 in. Barney " " " " "
No. 3 Brown & Sharpe Universal Milling Machine.
60 in. Pond Boring and Turning Mill, 2 Heads.
72 in. Newark Mach. Tool Co. Pulley Lathe, 2 Tools.
26 in. Stevens Pulley Lathe, 1 Tool.

700 Machine Tools in Stock. Send for Lists. Bicycle Catalog Just Out.

PRENTISS TOOL AND SUPPLY CO.
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SECOND-HAND MACHINERY.

36" Gould & Eberhardt Gear Cutter.
26" Pratt & Whitney Chucking Lathe.
60" Triple-geared New Haven Lathe, with chuck jaws.
40" New Haven Back-geared and Power-feed Drill.
32" Double-head Pond Planer.
No. 1 Giant Key Seater.

Send for complete list. Send for catalogue of Bicycle machinery.

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Buildings and Land for light or medium manufacturing, in manufacturing center of a New England city of 100,000 inhabitants.

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Full particulars given. Box No. 131, AMERICAN MACHINIST.

FOR SALE BY THE
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4 Pratt & Whitney No. 1 six-spindle drills with screw attachment for elevating table and doors, for covering spindles at $175 each.

3 Pratt & Whitney four-spindle drills with screw attachment for elevating table and doors, for covering spindles, at $125 each.

1 Pratt & Whitney three-spindle drill with doors for covering spindles, at $100.

SECOND-HAND TOOLS.

MODERN STYLE. FIRST-CLASS ORDER.
Will Be Sold Very Low Before Removal.

ENGINE LATHE—Flather, 14 x 6 ft., Hollow Spindle, Cross Feed.
" " Blaisdell, 16 x 6 ft., Raise and Fall Rest.
" " Pratt & Whitney, 16 x 7 ft., Raise and Fall Rest.
" " Putnam, 16 x 8 ft., Raise and Fall Rest.
" " Flather, 18 x 8 ft., Hollow Spindle, Cross Feed.
" " Pond, 20 in. x 15 ft., Extra Heavy, A 1.
" " Harrington, 20x10 ft., Compound Rest, Cross Feed
" " Fay & Scott, 36x18 ft., Compound Rest, Cross Feed.
" " Pratt & Whitney, 42 in., raising blocks to 48 in., Triple Geared, Compound Rest and Cross Feed. A 1 order.
" " Hewes & Phillips, 60 in. x 20 ft., Triple Geared, Compound Rest, etc. A 1.
" " Union, 72 x 20 ft., Triple Geared Screw Feed.
PLANER—Pease, 22 x 5 ft., Heavy Pattern, Improved Style. A 1.
" Hendey, 22 x 5 ft., Improved Style. A 1.
" Gould & Eberhardt, 26 in. x 8 ft. A 1.
" Pond, 32 in. x 8 ft. Good order.
" Pond, 36 x 12 ft. A 1 order.
" Betts 36 x 10 ft., Extra Heavy.
" Gray, 48 x 12 ft., Spiral Geared, Improved A 1.
" Betts, 60 x 16 ft., 4 Heads, Extra Heavy. A 1.
" Crank 12 in. stroke, "Pond's."
SHAPER—Gould & Eberhardt 15 in. Crank.
" Prentiss 17 in. Crank. Good as new.
" Hendey 24 in. Friction. Good order
" Pratt & Whitney 14 in. x 60 in., Traveling Head, 2 Tables.
" Fitchburg 14 in. Traveling Head, 28 in. Feed
" Warren 14 in. stroke, Traveling Head. A 1 order.
DRILL—Prentice 26 in., Friction Pulleys for tapping.
" Blaisdell 28 in., Back Gears.
" Hamilton 28 in., Back Gears, Automatic Feed.
" Pond 32 in. Extra Heavy, Back Gears, Automatic Feed.
MILLING MACHINE—Pratt & Whitney No. 2 Hand Feed and Vise.
" " Garvin No. 3, Power Feed, Vise, etc
" " Kempsmith Universal Miller. Good as new.
" " Lincoln Pattern with Vise.
SCREW MACHINE—Jones & Lamson, 2 in. Hole Friction Back Gears, Chasing Bar and Turret Feed complete with Tools. A 1 order.
" " Niles, 2 in. hole, Carriage Feed with Tools.
GEAR CUTTER—Gould & Eberhardt, 25 in. Automatic.
" " Gould & Eberhardt, 30 in. Automatic.
" " Gould & Eberhardt, 36 in. Automatic.
" " Hewes & Phillips, 60 in. Semi-Automatic.
PRESSES—Bliss No. 18 and 19.
" Stiles No. 1, 2 and 3.
Horizontal Boring and Drilling Machine Sellers 60 in.
Upright Boring and Turning Mill, 38 in. 2 Heads. A 1.
Steam Hammer 300 lb., Ferris & Miles.
Boiler Punch, 24 in. Gap, Standard Size.
Boiler Rolls, 10 ft., Improved Style. A 1.
" " 8 ft., Extra Heavy.
" " 7 ft., Hilles & Jones. A 1.
" " 6 ft., Extra Heavy.

BICYCLE MACHINERY
CONSISTING OF SCREW MACHINES, MILLING MACHINES, DRILLS, LATHES, PRESSES, SHAPERS, Etc.

J. J. McCABE,
SUCCESSOR TO
E. P. BULLARD'S N.Y. Mach'y Warerooms.
14 Dey St., NEW YORK.

Machinists' Supplies and Iron.

NEW YORK, October 26, 1895.

Iron—American Pig—We quote standard Northern brands, $14 to $14.50 for No. 1; $13 to $13.50 for No. 2; $12.75 to $13.25 for No. 2 Plain, and $12.50 to $13 for Gray Forge. Southern brands, $14 for No. 1; $13.50 to $13.75 for No. 2; $13 to $13.50 for No. 3; $13.50 to $14 for No. 1 soft: $13 to $13.50 for No. 2 soft; and $12.50 to $12.75 for Foundry No. 4.

Antimony—The market is barely steady. Cookson's is quoted at 7¾c. to 8c.; Hallett's at 7c. to 7¼c., and Japanese at 6¾c.

Lard Oil—Prime City is quoted at 50c. to 51c.

Copper—The market is dull, and somewhat easier in tone. Lake Copper can be bought at 11¾c. to 12c., and Casting Copper is held at 11¾c. to 11½c.

Lead—The market is quiet, but prices are steady at 3.35c. to 3.37½c.

Spelter—The market remains dull and weak. Good Western brands are quoted at 4¼c. to 4.15c. for New York delivery.

Tin—The market remains firm with scarcely any new features. The demand by consumers is moderate only. The quotations are 14.65c. to 14.70c. for early deliveries.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

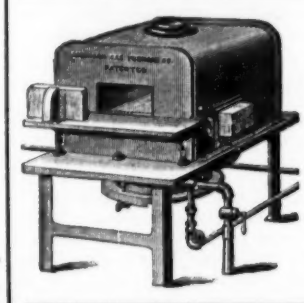
TO SUBSCRIBERS

whose names appear on our **subscription** list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Wanted—Bright, active machinists to canvass for subscription to AMERICAN MACHINIST, liberal commission. Address, with refs., Subscription Dep't, AMERICAN MACHINIST, 203 Broadway, N. Y.

Practical traveling draftsman and salesman desires position. Address B. E. C., care of AM. MACH.

(*Continued on Page 875.*)



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For the economical generation and systematic application of HEAT.

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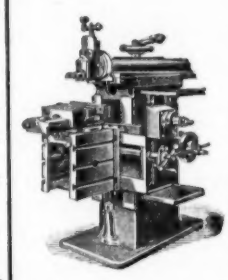

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Planers,

Milling Machines,

Drills,

Turret Machines and Machine Tools.

A LARGE STOCK

always on hand at low prices at

HILL, CLARKE & CO.,
Machinery Merchants,
156 Oliver St. BOSTON.
12 S. Canal St. CHICAGO, Ill.

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One Pratt & Whitney Automatic Rack Cutting Machine, table 31", horizontal traverse of table, 17", vertical adjustment of table, 6". Cuts any length of rack, latest pattern and complete with C. L.

One Pratt & Whitney Two spindle Profiling Machine. No. 2 Spindle with forming attachment, table 12" x 15, latest pattern and complete with C. L.

One Automatic Gear-Cutting Machine, cuts spur gears to 9" diam., has 13 index plates, arbors, etc., quick return to table and modern in design, complete, with C. L.

These machines actually as good as new. Can be seen at factory, Lowell, Mass.

Address all communications to

S. T. LUND,
CARE OF
Lamson Consolidated Store Service Co.,
LOWELL, MASS.

SEND FOR 250 PAGE ILLUSTRATED CATALOGUE.

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PERFORATIONS

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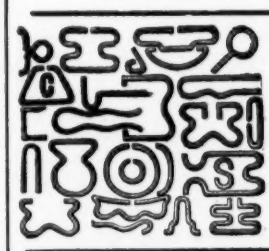
METAL WORKERS TOOLS AND SUPPLIES
10 & 12 N. CANAL ST. CHICAGO ILL. U.S.A.

MACHINE TOOLS.

IN FIRST-CLASS CONDITION.

16 in. F. B. Miles Slotting Machine.
2,400 Pound Miles Steam Hammer, Single Standard.
30 in. by 27 ft. Pratt & Whitney Engine Lathe.
Horizontal or Floor Boring Machine, Pratt & Whitney.
Two (2) 5 ft. Universal Radial Drills.
21 in. x 11 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
19 in. x 8 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
26 in. x 8 ft. Pond Machine Tool Co. Engine Lathe.
19 in. x 12 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
22 in. x 12 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
40 in. Bement Vertical Drilling Machine.
24 in. Pratt & Whitney Vertical Drilling Machine.

GEORGE PLACE MACHINE CO.,
145 Broadway & 86 Liberty St., New York.



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PIN, SAFETY PIN, HOOK AND EYE MACHINERY,

AND LABOR-SAVING MACHINES OF EVERY DESCRIPTION.

Bent Wire Goods a Specialty. Send Samples that we may quote prices for either machine or the Goods.

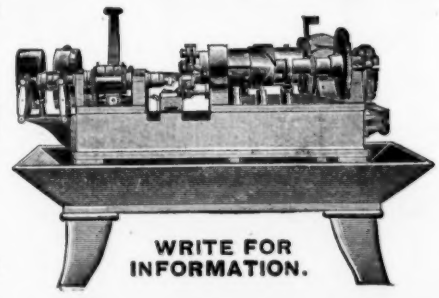
STEEL BALLS

For all Anti-Friction Purposes.

WE ALSO MANUFACTURE

AUTOMATIC SCREW MACHINES
AND
SCREW MACHINE PRODUCT
OF EVERY DESCRIPTION.

Cleveland Machine Screw Co.,
CLEVELAND, OHIO.



WRITE FOR INFORMATION.

Wanted—Pos. by draftsman: technical graduate, with shop experience. W. M. C., Am. Machinist.

Practical mechanical draftsman desires position. New York City preferable. K., Am. Machinist.

Sit. Wanted—By man who thoro'ly understands the manufacture of steel balls. Box 149, Am. Mach.

Wanted—A few reliable agents to sell my calipers on commission. E. G. Smith, Columbia, Pa.

Wanted—Situation by a first-class patternmaker on plumbers' supplies; good references. Address P. M., care American Machinist.

Competent designer of experimental machinery, wants pos.; 10 yrs. exp., references, technical education, reasonable terms. Box 147, Am. Machinist.

Wanted—Position as foreman. Eight years in charge of machine-tool work. References. Age, 33. Address Box 148, American Machinist.

Expert mech. draftsman, prac. mach. & patternmaker, wishes position; New York or vicinity. Extensive shop and office exp. Box 150, Am. Mach.

Responsible position wanted by practical mechanic and draftsman. Had considerable exp. in designing tools and mach., and held pos. as chief draftsman and assistant supt. A. B., Am. Mach.

Responsible position by competent party, experienced in estimating, designing and building at least cost high-grade machinery. Has had charge of shops and office before. Box 217, Baltimore.

Foreman for mach. shop—15 to 20 men—medium weight mach'y and general jobbing; chance for right man to grow; state experience, and wages expected. Connecticut, care Am. Machinist.

I would like to correspond with parties desiring the services of an experienced foundry foreman or superintendent understanding the foundry in all its details. Engine, machinery or electrical work preferred. Address "Loam," American Machinist.

Wanted—Foundry foreman; one who can work 100 men if necessary, on general machinery castings. One who understands melting and mixing, and can produce *best quality* work at a reasonable cost. No experimenter need apply. Permanent position and good wages. Coke, Am. Machinist.

Wanted—An intelligent man in every machine shop in New England to utilize his spare time in raising clubs of subscribers for the American Machinist; liberal commission. Address, with references, John A. Walker, N. E. Agent, No. 4 Church Street, Dorchester, Mass.

Wanted—A first-class draftsman. Would prefer one who is a practical machinist and who has had large experience in designing and constructing coal mine equipments, such as hoisting and haulage engines, ventilating fans, revolving and shaker screens, etc.; please state age, reference, experience, and salary expected. Address M. & F. D., care of American Machinist.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—A first-class key-seater, new. Address Mitts & Merrill, 913 Tilden St., Saginaw, Mich.

Best and cheapest Bolt Header made by C. H. Baush & Sons, Holyoke, Mass.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Wanted—Machinery to build: special, steam, mill, hydraulic. F.C. & A. E. Rowland, New Haven, Conn

For Sale—Tabor duplex automatic molding machine with 18-inch cylinder; molds two flasks 12x15, or one flask 15x24 inches; perfect condition. Box 94, American Machinist.

Machine shop to let. Rent, $35 per month, including use of tools and steam power. Moore & Warren, 57 John street, New York.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offer.

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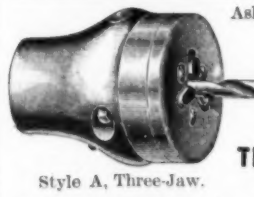

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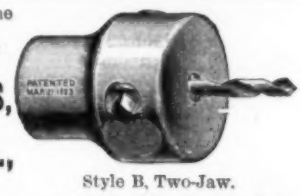
Strong, Accurate, Durab'e, Cheap,

THE E. HORTON & SON CO.,
Windsor Locks, Conn., U. S. A.



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Or CHAS. CHURCHILL & CO., Ltd., 21 Cross St., Finsbury, London, Eng. **Awards at the World's Fair.**

"CUSHMAN" CHUCKS.

For Lathes, Drills, Chucking and Screw Machines, and for Special work.

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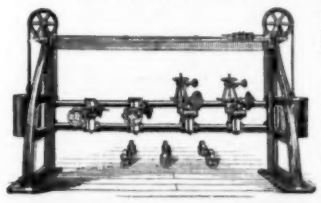

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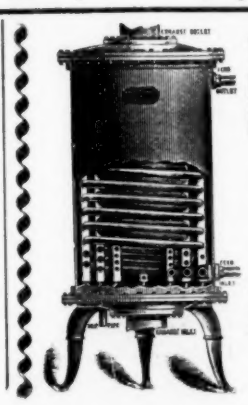

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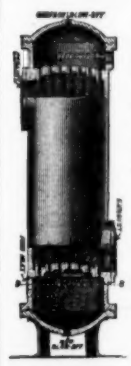

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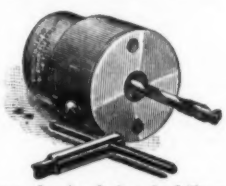

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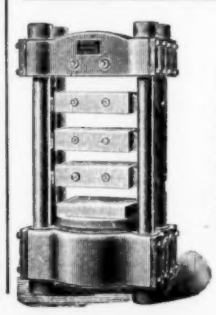

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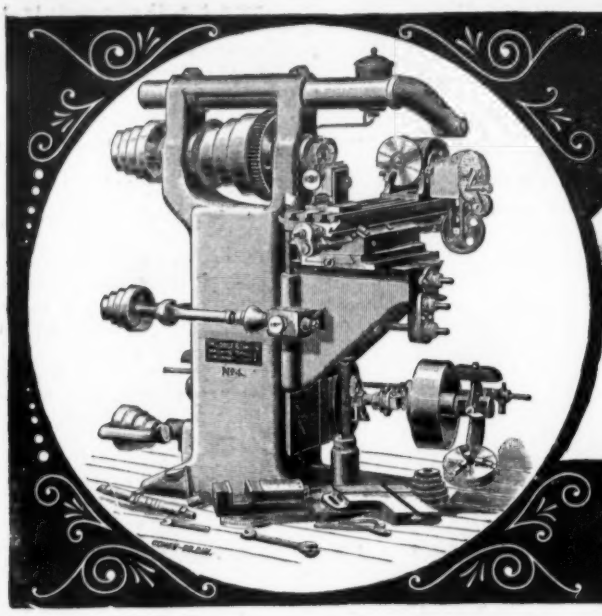

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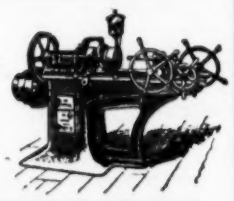

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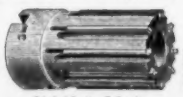
Adjustable  SHELL REAMERS

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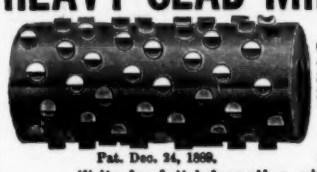

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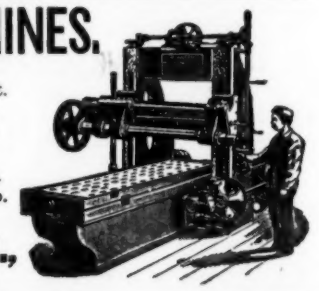

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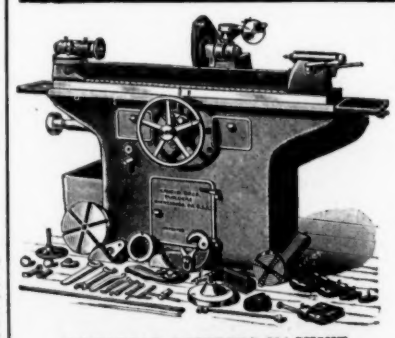

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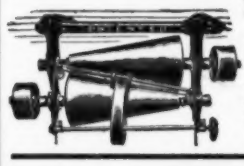

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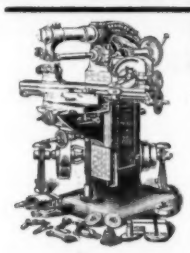

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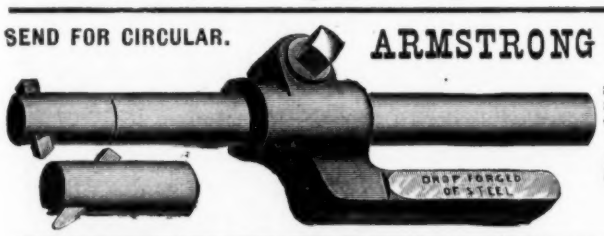

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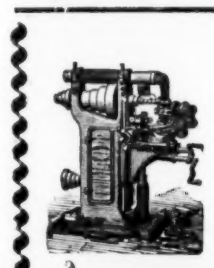

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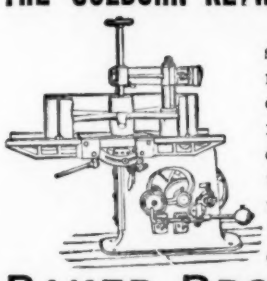

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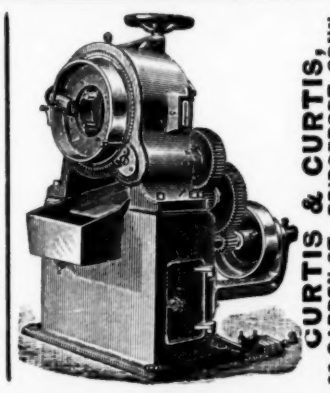

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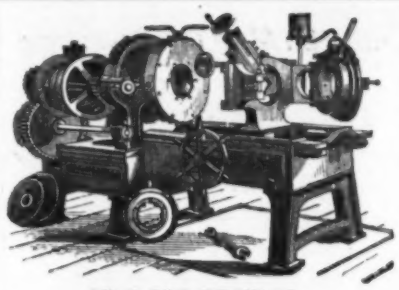

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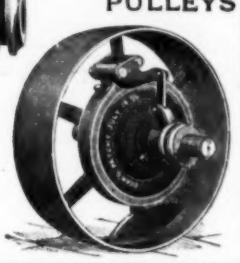

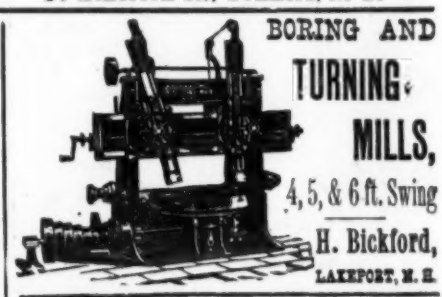

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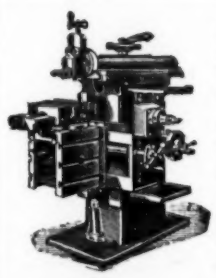

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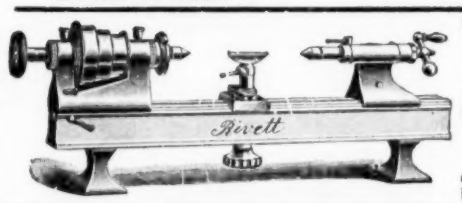

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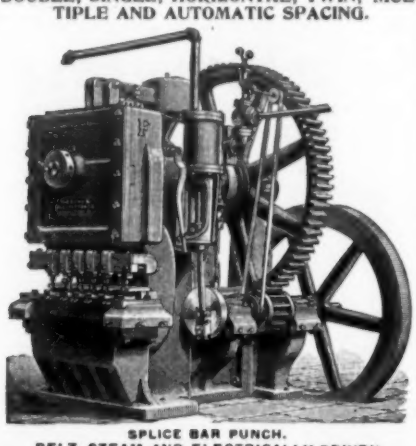

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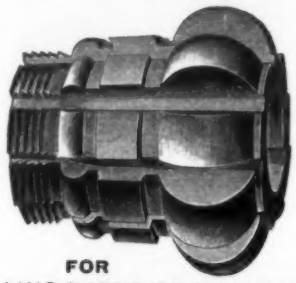

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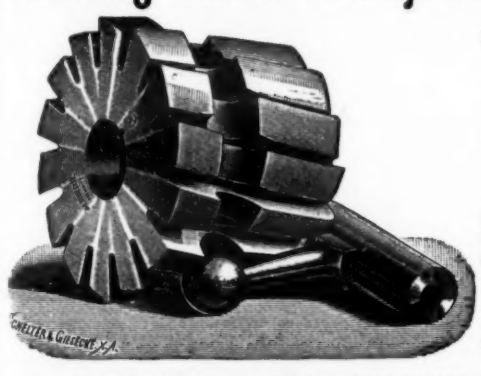

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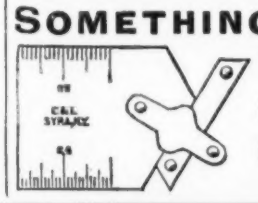

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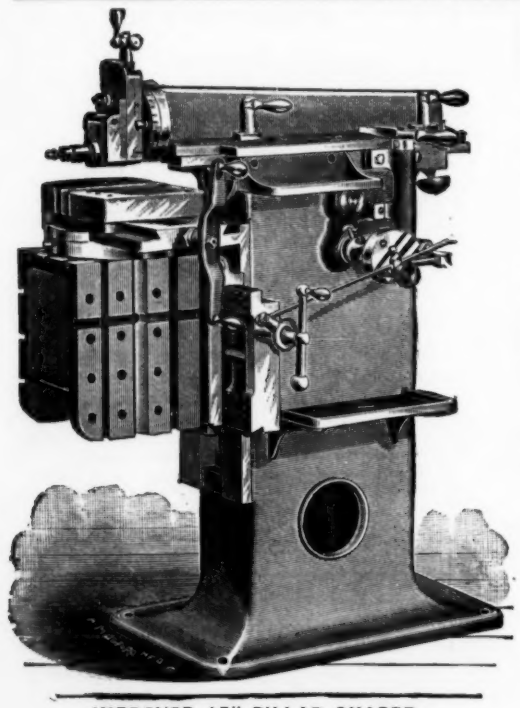

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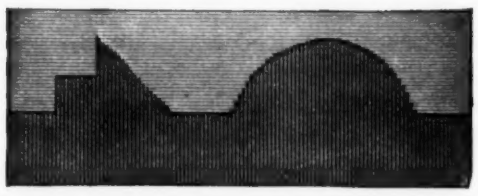

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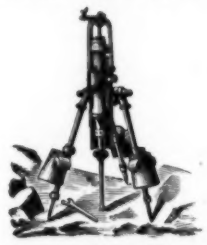

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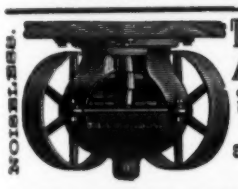

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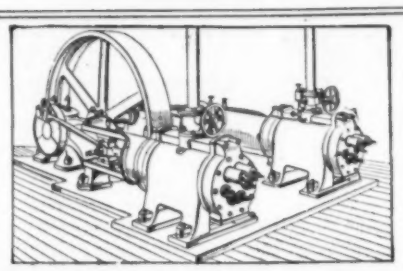

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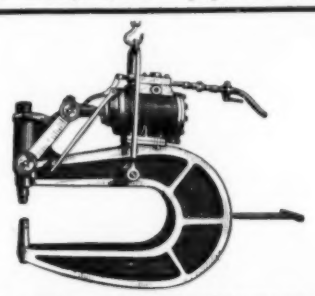

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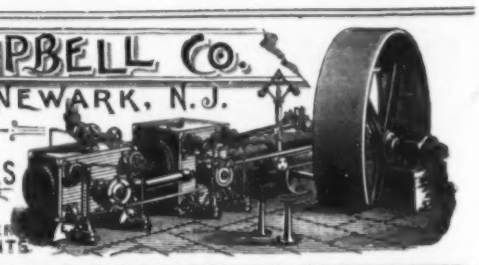

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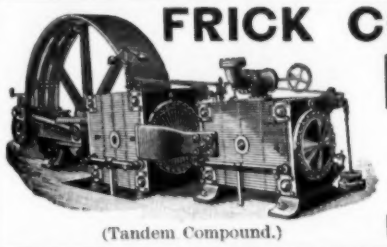

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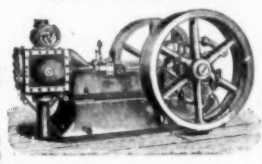

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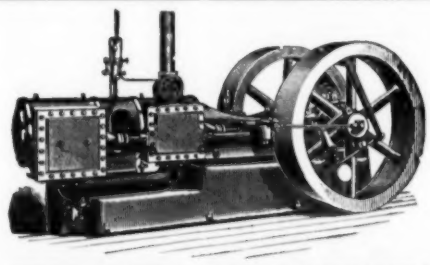

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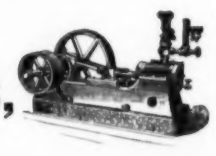

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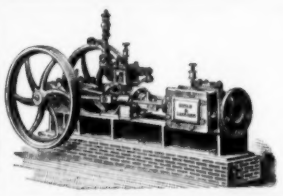

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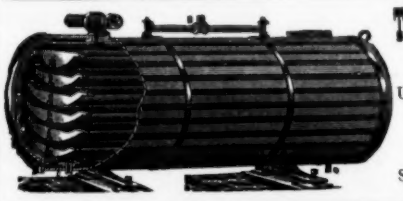

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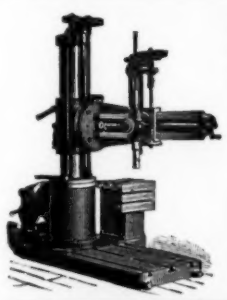

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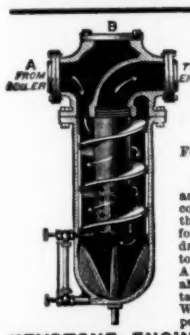

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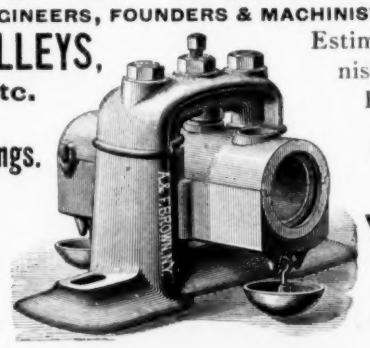

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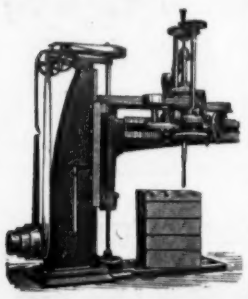

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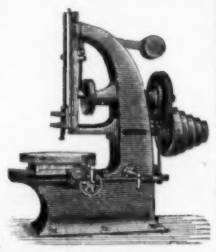

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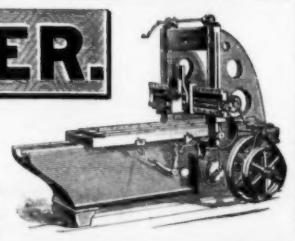

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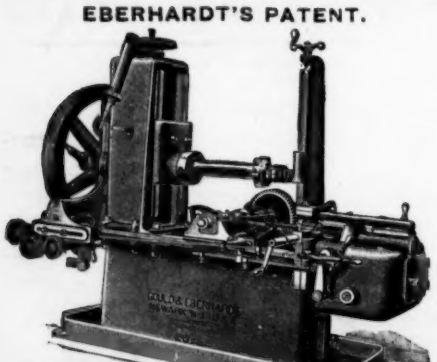

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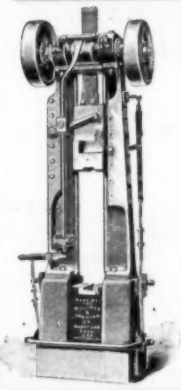

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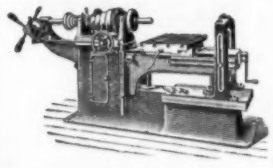

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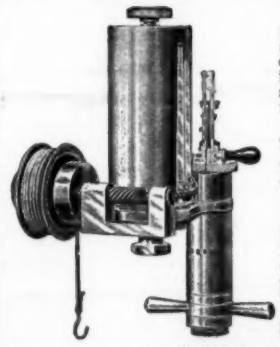

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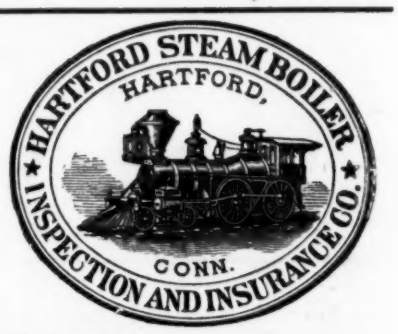

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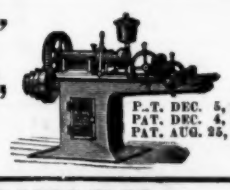

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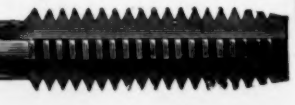

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